DRAFT FINAL

Amended Closure/Post-Closure Plan, Hazardous Waste Storage Area (Building 560)

Rickenbacker Air National Guard Base
Columbus, Ohio

Prepared For

Air Force Center for Environmental Excellence
Technology Transfer Division
Brooks Air Force Base
San Antonio, Texas

20000906 145

and

Rickenbacker Air National Guard Base
Columbus, Ohio

February 1997

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DRAFT FINAL

AMENDED CLOSURE/POST-CLOSURE PLAN
HAZARDOUS WASTE STORAGE AREA
BUILDING 560

at

RICKENBACKER AIR NATIONAL GUARD BASE
COLUMBUS, OHIO

February 1997

Prepared for:

AIR FORCE CENTER FOR ENVIRONMENTAL EXCELLENCE
TECHNOLOGY TRANSFER DIVISION
BROOKS AIR FORCE BASE
SAN ANTONIO, TEXAS

AND

RICKENBACKER AIR NATIONAL GUARD BASE
COLUMBUS, OHIO

Prepared by :

Parsons Engineering Science, Inc.
1700 Broadway, Suite 900
Denver, Colorado 80290

EXECUTIVE SUMMARY

This amended closure/post-closure plan describes the proposed closure approach for the former hazardous waste storage area (HWSA) at Building 560, Rickenbacker Air National Guard Base (ANGB), Ohio. The former HWSA is located at the edge of the shop area in the northern section of the base. The HWSA was a permitted storage facility that received wastes generated during base activities from 1983 to 1986. Wastes stored in the HWSA consisted primarily of acids and spent desiccants. Waste was stored in small containers placed on pallets inside Building 560 and in larger, 55-gallon drums outside the building (within the fenced yard). Additionally, 15 underground storage tanks (USTs) were previously located at Building 560/HWSA. These USTs were used for the storage of waste fuel, waste oils, and deicing fluid. The Air Force Base Conversion Agency (AFBCA) has been granted "No Further Response Action Plan" (NFRAP) status for the tanks. Residual contamination in soil and groundwater is addressed as part of the closure approach presented in this closure/post-closure plan. This amended closure/post-closure plan was prepared in compliance with the Ohio Administrative Code (OAC) Chapter 3745 Part 66 and the Code of Federal Regulations (CFR), Title 40 Part 265, Subpart G.

The HWSA was initially proposed to be closed as a landfill (i.e., installation of a cap) with engineered groundwater remediation via extraction and treatment (E&T) to be conducted during the post-closure period. This proposed closure approach, as described in a March 1993 amended closure/post-closure plan, was approved by the Ohio Environmental Protection Agency (Ohio EPA) on July 13, 1993. However, after further review of existing site characterization data, the AFBCA questioned the effectiveness of the proposed groundwater remediation approach.

Subsequently, Parsons Engineering Science, Inc. (Parsons ES) was contracted by the Air Force Center for Environmental Excellence (AFCEE) to determine whether other remedial approaches and/or technologies could be used in lieu of the proposed closure approach, especially the engineered groundwater E&T system. The emphasis of this effort was to evaluate the potential for natural chemical attenuation processes to minimize contaminant mass, mobility, persistence, and toxicity. The findings of this focused evaluation and revised closure recommendations were documented in an October 1995 amended closure/post-closure plan. On August 26, 1996, after review of the October 1995 plan, Ohio EPA informed the AFBCA (and AFCEE/Parsons ES) that reliance on natural chemical attenuation processes as the sole remedial action for closure would not be approved. Ohio EPA recommended at that time that other remedial technologies be considered to supplement natural attenuation processes to achieve closure of the HWSA.

A revised amended closure/post-closure plan for the HWSA was submitted to Ohio EPA by the AFBCA on October 11, 1996. The proposed closure approach described in the October 1996 plan included:

- Decontamination of Building 560 by cleaning the building and drum wash pad (completed April 1996);

- Removal of remaining USTs (completed February 1995);
- Limited *in situ* remediation of organic soil contamination via passive or forced air injection bioventing;
- Natural oxidation of residual dissolved fuel hydrocarbons and natural reductive dehalogenation of residual dissolved chlorinated hydrocarbons;
- *In situ* remediation of residual dissolved chlorinated hydrocarbons via groundwater amendment (passive or active oxygenation), as necessary;
- Continued monitoring and site access controls as part of post-closure commitments; and
- Eventual total site exposure control by installation of taxiway (proposed as future land use).

This proposed closure approach is intended to supersede the closure approach presented in the approved 1993 closure/post-closure plan. Additional site assessment activities are being undertaken by the AFBCA to optimize final designs for the engineered components of the proposed closure approach and to establish long-term closure objectives for the site. Should this proposed closure approach prove insufficient to meet closure objectives, the AFBCA would consider implementation of alternate, high-cost contingency actions (e.g., cap installation).

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SECTION 1

FACILITY DESCRIPTION

1.1 INTRODUCTION

This amended closure/post-closure plan is submitted by Rickenbacker Air National Guard Base (ANGB, the Base), in compliance with the Ohio Administrative Code (OAC) Chapter 3745 Part 66, and Code of Federal Regulations (CFR) Title 40 Part 265, Subpart G. As part of the Installation Restoration Program (IRP), Rickenbacker ANGB has identified the former hazardous waste storage area (HWSA) at Building 560 for closure. Initially, Rickenbacker proposed to close the HWSA as a landfill with groundwater remediation to be conducted during the post-closure period. This closure approach consisted of engineered groundwater remediation with an extraction and treatment system, followed by installation of a cap. This proposed closure approach, as described in a March 1993 amended closure/post closure plan, was approved by the Ohio Environmental Protection Agency (Ohio EPA) on July 13, 1993.

In January 1995, the Air Force Base Conversion Agency (AFBCA), which took over responsibility of closure of the HWSA in September 1994, informed Ohio EPA that the effectiveness of the approved groundwater extraction and treatment system was being questioned. To determine whether other remedial approaches and/or technologies could be used in lieu of the proposed closure approach, especially the engineered groundwater extraction and treatment system, Parsons Engineering Science, Inc. (Parsons ES) was contracted by the Air Force Center for Environmental Excellence (AFCEE) in February 1995 to perform an investigation at the HWSA to determine if natural chemical attenuation processes in site groundwater are occurring, and, if so, whether these processes are sufficient to minimize contaminant mass, mobility, persistence, and toxicity. The findings of this evaluation and revised closure recommendations were documented in an October 1995 amended closure/post closure plan. On August 26, 1996, after review of this amended closure/post closure plan, Ohio EPA informed the AFBCA (and Parsons ES) that reliance on natural chemical attenuation processes as the sole remedial action for closure would not be approved. Ohio EPA recommended at that time that other remedial technologies be considered to supplement natural attenuation processes to achieve closure of the HWSA.

This version of the amended closure/post closure plan describes the additional engineered remedial actions that are proposed to be implemented at the former HWSA to supplement natural chemical attenuation processes, which have been documented to be occurring in site groundwater. This proposed closure approach is intended to supersede the closure approach presented in the approved 1993 closure/post closure plan.

The HWSA is located at Base Building 560, which was regulated under US Environmental Protection Agency (USEPA) Interim Status Permit #OH3571924544. Building 560 was decontaminated in April 1996 in preparation for closure, as described in Section 5 of this report and in a June 1996 technical report (AFCEE, 1996). Building 560 housed water demineralization equipment prior to being converted to hazardous waste storage in 1983. The HWSA (Building 560) was then used from 1983 until 1986 for the storage of drummed wastes generated at the Base.

Environmental investigations were conducted at the HWSA in 1989, 1990, and 1991 to determine the nature and extent of contamination at the site. To more completely define the extent of contamination and to document the potential feasibility of relying on natural chemical attenuation processes as a potential remedial approach for groundwater ~~remediation~~, additional field work was conducted in February and March of 1995. **Results of several**~~Ongoing~~ quarterly groundwater sampling events, **which were** completed in August and December 1995 and March 1996, also **were considered when evaluating potential remedial approaches for groundwater**~~have been completed~~.

1.2 REPORT ORGANIZATION

This amended closure/post closure plan consists of 11 sections, including this introduction, and 5 appendices. A general site background, including an overview of the environmental setting, is provided in the remainder of this section. Section 2 presents more detailed information on the site background, including a review of recently-completed closure activities related to Building 560 and a number of underground storage tanks (USTS) located on or adjacent to the site. Section 3 presents a summary of the wastes that were stored at the site, in tabular form. Section 4 summarizes the scope of environmental investigation activities conducted at the site to date, and presents available data to characterize physical conditions and the nature and extent of residual contamination in soil and groundwater. The proposed closure approach, including a description of the various remedial technologies and approaches, is presented in Section 5. Section 6 presents the proposed sampling and analytical plan for soil and groundwater during closure activities and post-closure monitoring. Section 7 describes the personnel health and safety procedures for closure and post-closure activities. Section 8 presents a schedule for closure activities. Post-closure activities are summarized in Section 9. An estimate of closure and post-closure costs is provided in Section 10. Section 11 presents references used in preparing this amended closure/post closure plan.

Appendix A tabulates the analytical data collected at the site from 1988 through 1990. Appendix B presents relevant text and figures from the 1988-1990 investigations, and a summary of the 1991 sampling results. Boring logs, monitoring well construction details, and 1995 conepenetrometer (CPT) logs are presented in Appendix C. Appendix D presents the laboratory reports for analytical data collected in early 1995 as part of the natural chemical attenuation investigation sponsored by the AFCEE. Appendix E summarizes the field and analytical results collected at the site in August 1995, December 1995, and March 1996. Analytical data from early investigations are presented on a site map in sheets attached at the end of the appendices.

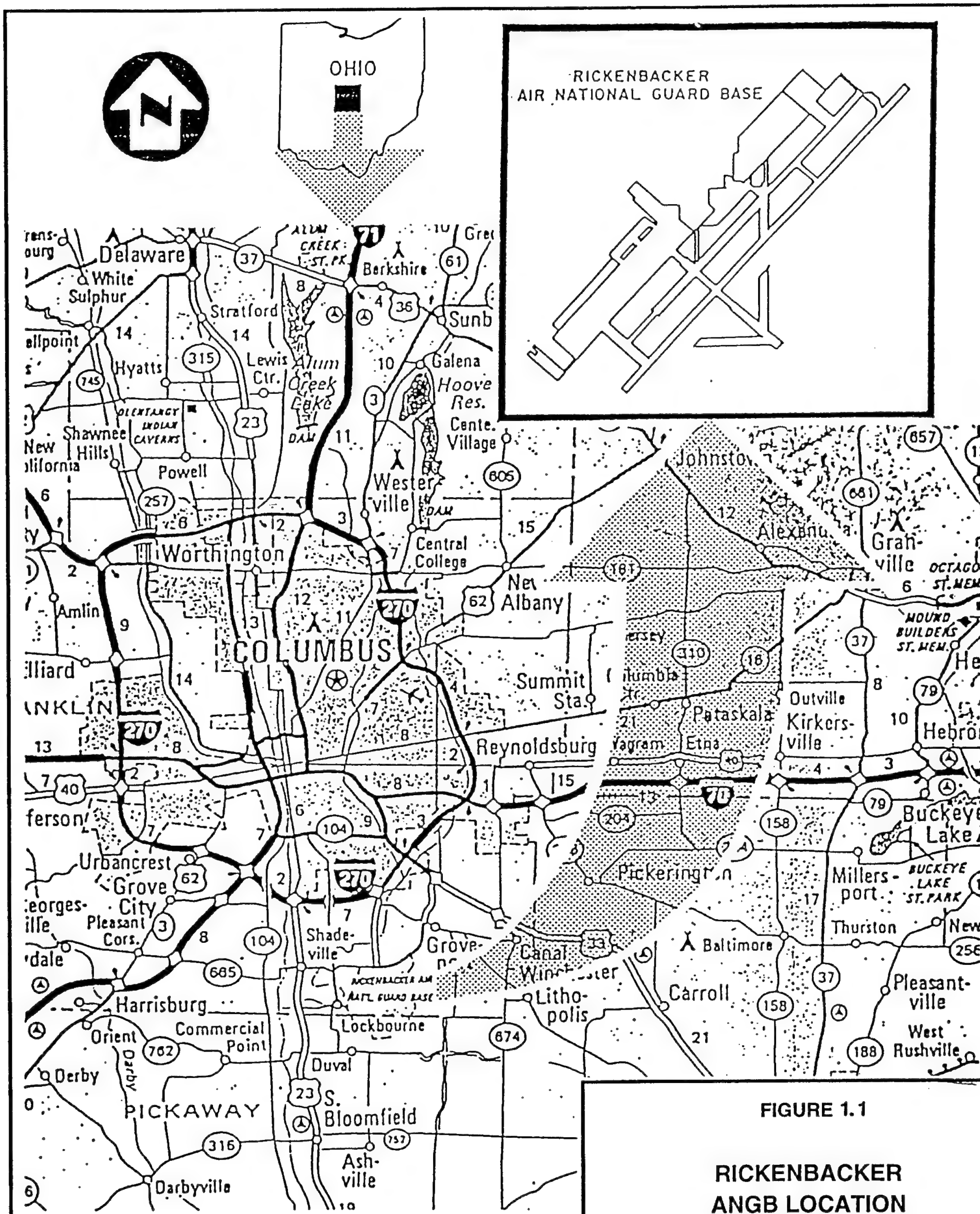
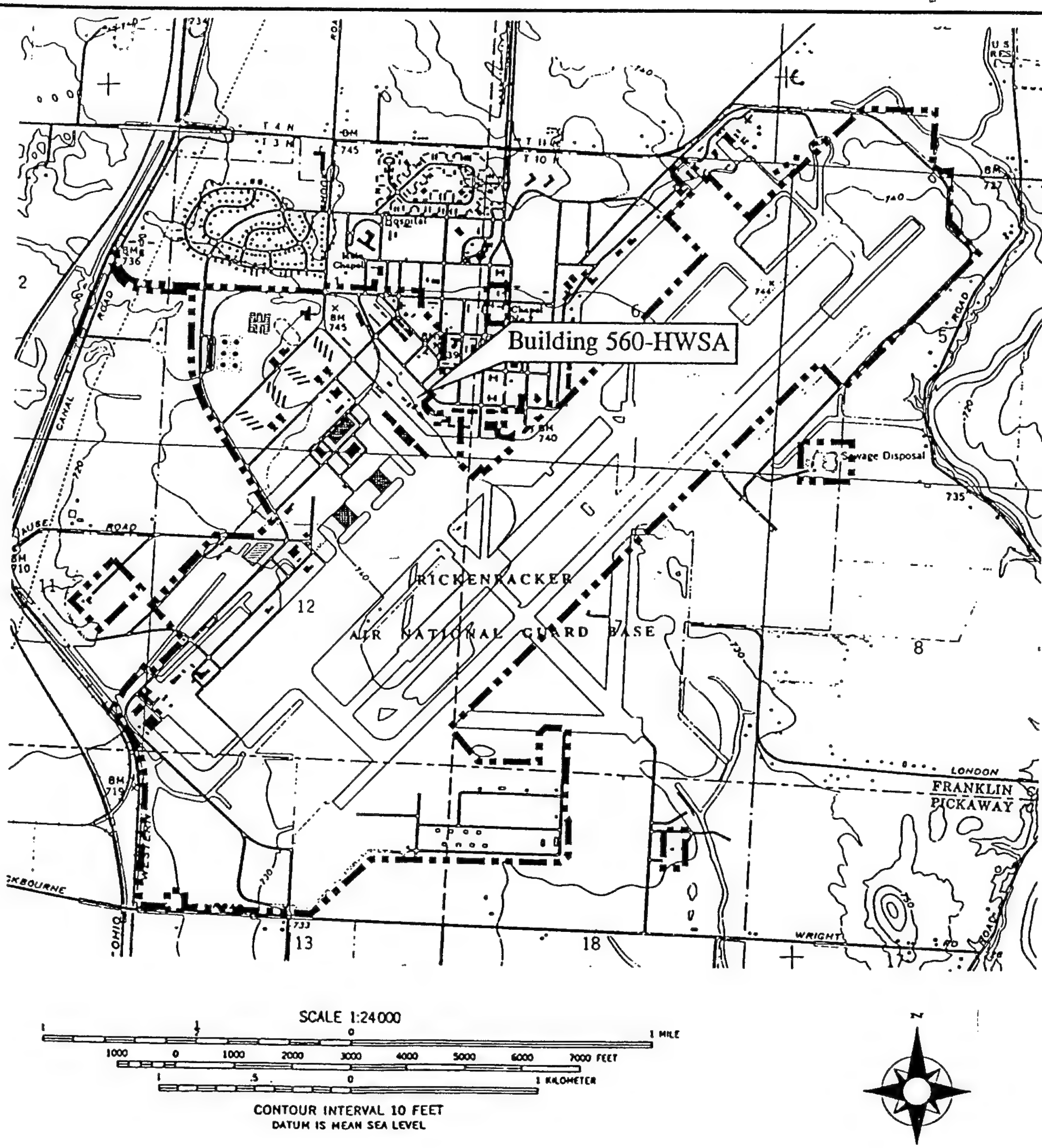


FIGURE 1.1

RICKENBACKER ANGB LOCATION

HWSA
Amended Closure/Post-Closure Plan
Rickenbacker ANGB, Ohio

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado



Sources: USGS, 1985.

FIGURE 1.2

SITE LOCATION

HWSA
Amended Closure/Post-Closure Plan
Rickenbacker ANGB, Ohio

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

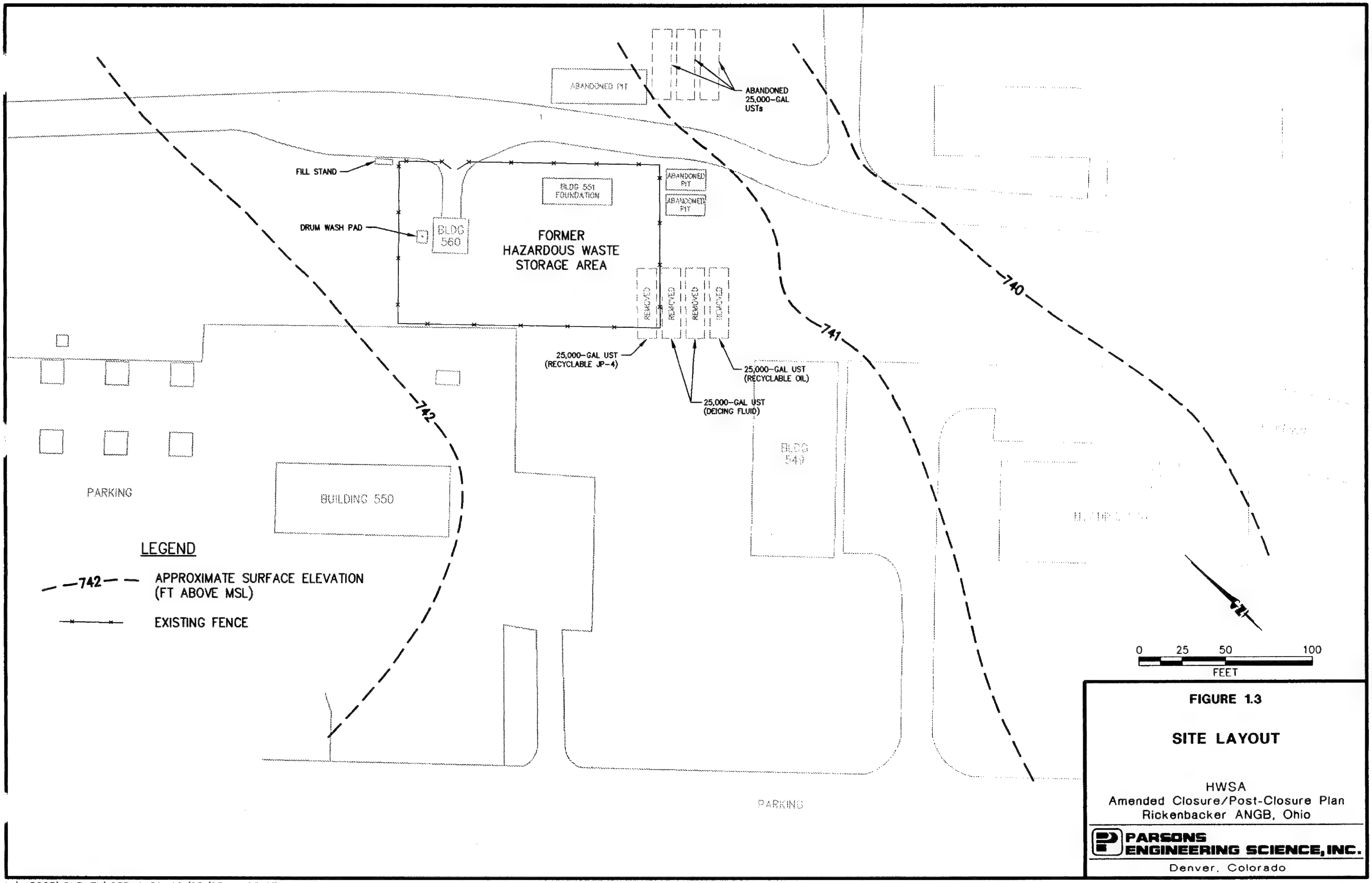


FIGURE 1.3

SITE LAYOUT

HWSA
Amended Closure/Post-Closure Plan
Rickenbacker ANGB, Ohio

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

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1.3 RICKENBACKER AIR NATIONAL GUARD BASE

Rickenbacker ANGB is located 12 miles southeast of Columbus, and 0.5 mile east of Lockbourne, Ohio (Figure 1.1). The Base covers approximately 2,100 acres in Franklin and Pickaway Counties and is located on a glacial till plain between the Big Walnut and Walnut Creek drainage basins. The area has been used as an air base under the custody of various government branches, including the Army Air Corps and the Air National Guard since 1942. Access to the Base is restricted through a continually guarded entrance.

The former HWSA is located at the edge of the shop area in the northern section of the Base (Figure 1.2). The HWSA was a permitted storage facility that received wastes generated during Base activities from 1983 to 1986, when it was closed. The HWSA encompasses a fenced, grass-covered area measuring 170 feet by 95 feet and includes a 10-foot by 20-foot steel building on a concrete slab identified as Building 560 (Figure 1.3). Wastes were stored in drums placed on pallets inside Building 560 and outside within the fenced yard.

Closure activities for eleven USTs associated with Building 560/HWSA (Tanks #51 through #57, #106, #160, #161, and #162) were conducted in May through August 1994. These tanks were used previously to store petroleum, diesel, and kerosene. Four additional USTs (Tanks #47 through 50) at the HWSA were removed in February 1995. These USTs were used for the storage of waste fuel, waste oils, and deicing fluid. The activities that generated the wastes stored in the HWSA include degreasing operations at Base shops, aircraft cleaning, and general maintenance activities (painting, paint stripping, etc.).

1.3 ENVIRONMENTAL SETTING

The environmental setting of the Base is described in this subsection, with an emphasis on the identification of natural features that may influence the migration of hazardous-waste-related contaminants from this facility.

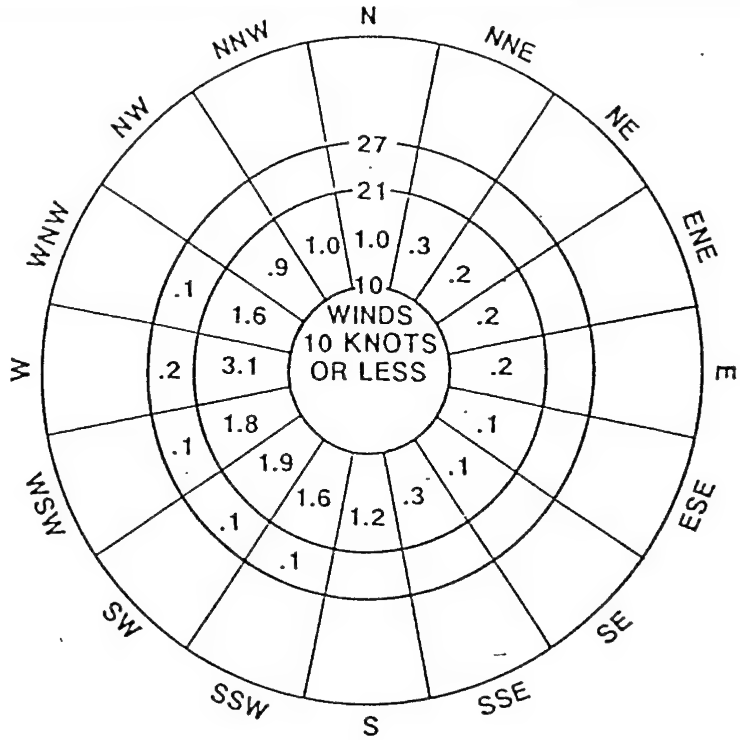
1.3.1 Meteorology

The climate of Columbus, Ohio is continental, characterized by cold winters, hot summers, and moderate rainfall (Pierce, 1959). The mean annual temperature is 52 degrees Fahrenheit (°F). The coldest month is January, with a mean temperature of 30°F; the warmest month is July, with a mean temperature of 74°F. Precipitation at the Base falls primarily during the summer months, with June being the wettest month and October being the driest month. The mean annual precipitation at the Base is 38 inches. The prevailing wind directions on the Base are from the southwest to north-northwest, as illustrated on Figure 1.4.

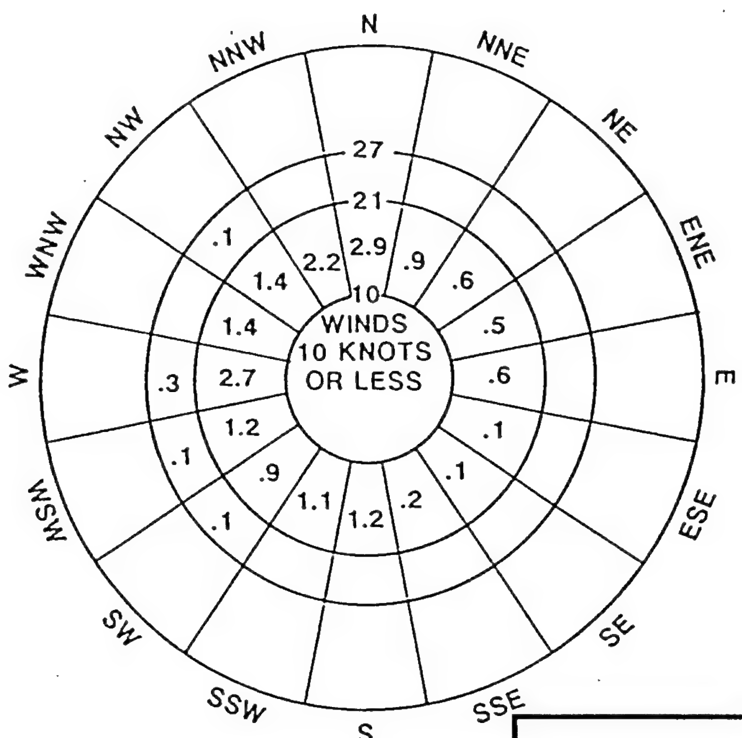
1.3.2 Regional Geology

The Base is located in the Glaciated Central Lowlands Province, just west of the Appalachian Plateau Province. The geology of the area is characterized by up to 200 feet of Pleistocene sandy and gravelly glacial outwash and silty and clayey glacial till filling a preglacial bedrock valley (Schmidt and Goldthwaite, 1958). Bedrock

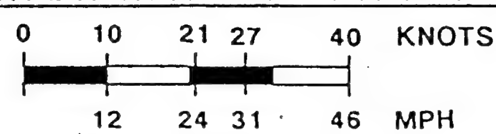
ALL WEATHER



INSTRUMENT



AIR FORCE RUNWAY WIND COMPUTER



NOTE THESE WIND ROSES SHOW THE TOTAL % OF WINDS BY SPEED GROUP AND DIRECTION BASED ON TRUE BEARING.

Sources: ES, 1993.

FIGURE 1.4

ANNUAL WIND ROSES FOR THE BASE

HWSA
Amended Closure/Post-Closure Plan
Rickenbacker ANGB, Ohio

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

underlying the valley fill consists of Devonian-age limestones and shales of the Columbus and Delaware Formations.

1.3.3 Regional Soils

Soils mapped at the Base are of the Kokomo and Crosby Series (Soil Conservation Service, 1976). The soils are characterized as deep, very poorly drained, slowly to moderately slowly permeable soils formed in glacial tills on uplands. The Crosby series soils are formed on slopes with up to 6-percent grade, while the Kokomo series soils form on gentler 0- to 2-percent slopes on the higher landscape positions. The Crosby soils exhibit permeabilities of 0.06 to 0.6 inches per hour (in/hr) in unleached horizons. The Kokomo soils have permeabilities of 0.2 to 2.0 in/hr.

1.3.4 Regional Surface Water Hydrology

Rickenbacker ANGB occupies the drainage divide between Big Walnut Creek and Walnut Creek. Surface drainage from the Base is controlled through an extensive storm drain network, which includes corrugated metal and concrete drainage pipes and open drainage ditches. All of the surface runoff is routed through oil/water separators before being released into surrounding surface streams, which ultimately discharge into Walnut Creek and Big Walnut Creek. Walnut Creek is the nearest permanent stream to the HWSA and is located approximately 1.5 miles east of the site.

1.3.5 Regional Groundwater Use

Groundwater is the primary source of drinking water in this area. **Although t**~~T~~here are six water supply wells located on the Base,~~.~~ **t**~~T~~hese wells are no longer used as a source of potable water. The Base and the nearby Village of Lockbourne receive their water supply from the City of Columbus. The depths of the ANGB former drinking water wells range from 201 to 232 feet below ground surface (bgs). The wells are screened in the glacial sands and gravels immediately above the shale bedrock. Static water levels in the drinking water wells range from 36 to 56 feet bgs. Testing of water from the wells for priority pollutants indicated no detectable contamination (Ecology and Environment, 1986).

Homes along the rural roads surrounding the Base are served by individual domestic water wells. These wells are completed in sand and gravel aquifers between 20 and 100 feet bgs.

SECTION 2

HAZARDOUS WASTE STORAGE AREA

2.1 SITE DESCRIPTION

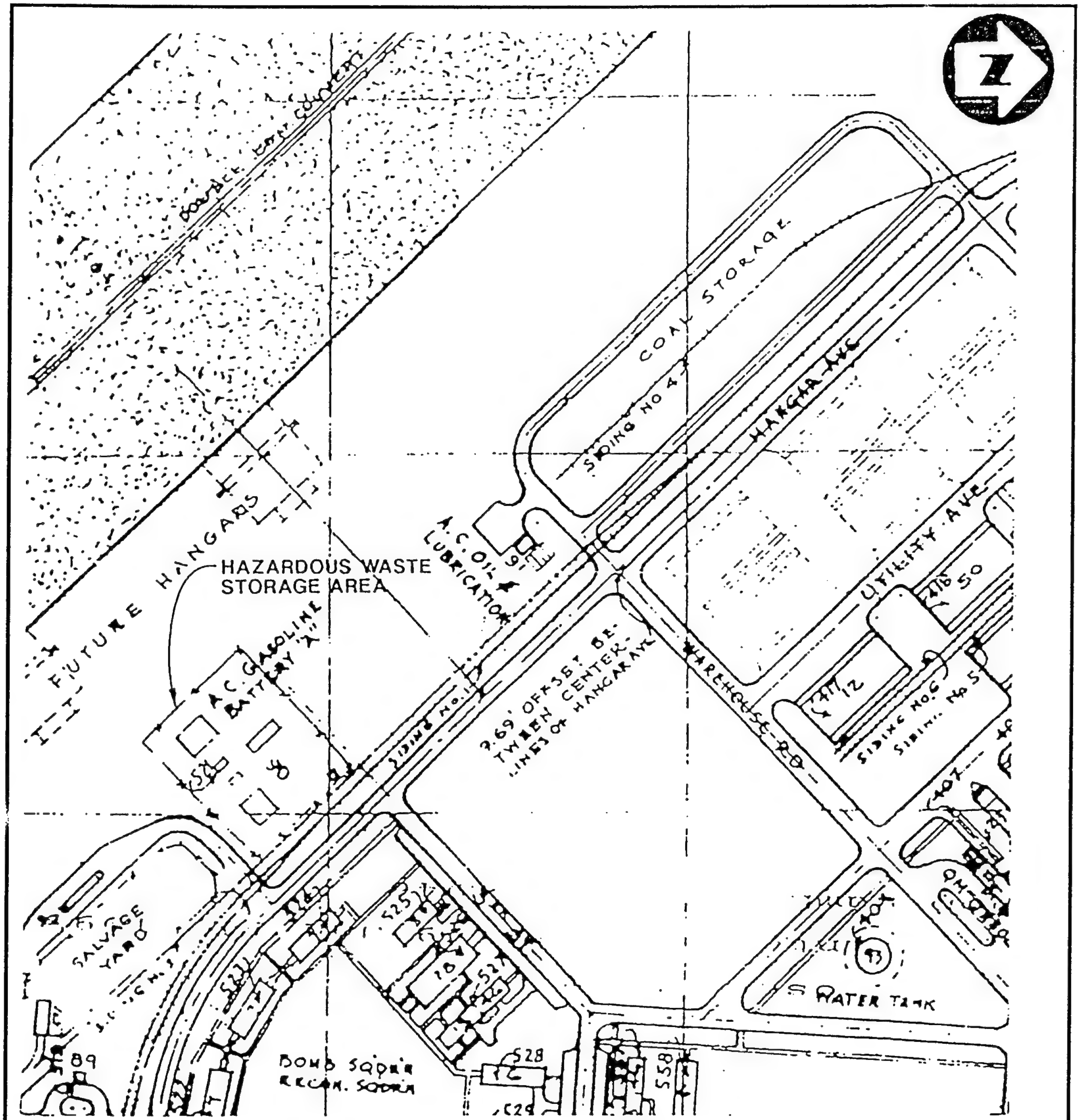
The site is located in the central area of the Base (Figure 1.2). The HWSA measures 170 feet by 95 feet, and is surrounded by a chain-link fence with a locking gate (Figure 1.3). A majority of the site is unpaved and vegetated with grasses. There is a paved driveway that leads to the now-decontaminated Building 560, and the floor of the building is paved with concrete. The area surrounding the site is very level and also is vegetated with grasses. To the north and east of the site is a gravel road, and beyond the road are railroad tracks that are no longer in use. The area to the south and west is currently used as a storage yard for stockpiled telephone poles and drummed material. To the south and east of the site are office buildings and parking lots. Beyond the buildings to the east are the Base runways. These runways receive air traffic consisting of various military aircraft and private aircraft associated with the Rickenbacker Port Authority.

2.2 SITE HISTORY

The area where the HWSA was constructed had various other uses in the past. Historical aerial photographs, maps, and drawings indicate that the site had been used for a storage yard, probably for drummed lube oils. When the Base was first constructed in 1942, individual buildings were heated with coal. The coal storage area for the Base was located west of the HWSA, adjacent to the railroad tracks (Figure 2.1). The smokestack for a coal-burning furnace is still standing approximately 180 feet from the HWSA.

Records indicate Buildings 551 and 552 also were formerly located on this site. Fuel pumping operations were managed from these two buildings. One of the buildings housed the valve controls for fuel hydrants used to off-load fuel from rail cars. The foundation of Building 551 is still present at the site (Figure 1.3). Excavations and soil sampling were conducted adjacent to this foundation in 1990. These investigations indicated that the fill material surrounding that structure was not contaminated.

From 1974 to 1983, Building 560 (Figure 1.3) housed water demineralization equipment. In 1983, the building was converted to a hazardous waste storage facility. The conversion included sealing off all floor drains that led to storm sewers, connecting remaining drains to the sanitary sewer, and installing emergency eye-wash and shower fixtures.



200 0 200 FEET
SCALE

Sources: ES, 1993.

FIGURE 2.1

HAZARDOUS WASTE STORAGE AREA VICINITY

HWSA
Amended Closure/Post-Closure Plan
Rickenbacker ANGB, Ohio

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

Hazardous wastes were containerized and brought to the site from other areas of the Base. Drum contents were sampled to characterize wastes for disposal or reuse. Wastes were then turned over to the Defense Property Disposal Office (DPDO) for disposal or recycling. The DPDO is now known as the Defense Reutilization and Marketing Office (DRMO).

Building 560 (Figure 1.3) was used to store small (5 gallons or less) containers that usually held acids or spent desiccants. Other materials stored at this site were containerized in 55-gallon drums. As many as 165 containers at one time were stored on pallets in the grass area outside Building 560. Section 3 summarizes types and quantities of waste that were stored at the site from 1983 until 1986.

Building 560 consists of an empty 15' x 15' pre-engineered metal structure and an adjacent 4' x 4' concrete drum wash pad located inside a 95' x 100' fenced area. The HWSA was active from 1983 to 1986. During this period, small container (5 gallons or less) were stored inside the building while 55-gallon drums were stored outside the building within the fenced area which included the concrete drum wash pad. ~~The materials stored at the HSWA during this period consisted primarily of acids and spent desiccants.~~

Closure activities recently conducted at the site include:

- Decontamination of Building 560 and the adjacent concrete drum wash pad;
- Collection and analysis of building and concrete pad rinseate samples to confirm achievement of clean standards;
- Testing and disposal of containerized wash/rinse wastewater generated during decontamination activities; and
- Preparation of a report documenting the closure activities.

Details on the planned (and executed) closure activities associated with Building 560 are presented in Section 5 of this amended closure/post closure plan.

Four 12,000-gallon USTS (Tanks #53-57) and ten 25,000-gallon USTs (Tanks #47 through #52, #106, #160, #161, and #162) were previously located at the site. These USTs were removed in 1994 and 1995 (see Sections 1.2 and 5.2). The AFBCA **received**~~requested that~~ a "No Further Response Action Plan" status **from the Ohio Department of Commerce, Division of State Fire Marshal, Bureau of Underground Storage Tank Regulation (BUSTR) in March 1996,**~~be granted~~ for the tanks only. Residual contamination in soils and groundwater are to be addressed as part of the closure approach presented in this closure/post closure plan.

SECTION 3

HAZARDOUS WASTES STORED AT THE HAZARDOUS WASTE STORAGE AREA

Wastes from operations on the Base were stored at the HWSA from 1983 to 1986. No wastes have been stored at the site since 1986. Table 3.1 contains a summary of the types and amounts of waste stored at the HWSA.

TABLE 3.1
SUMMARY OF WASTES STORED AT THE HAZARDOUS WASTE STORAGE AREA
HAZARDOUS WASTE STORAGE AREA
AMENDED CLOSURE/POST-CLOSURE PLAN
RICKENBACKER ANGB, OHIO

		Quantity (by year)			
Waste Description	USEPA Haz. Waste No.	1983 (gals)	1984 (gals)	1985 (gals)	1986 (lbs)
PD 680 (Stoddard Solvent, Flammable Aliphatic Petroleum Distillate	D001	1,155	1,450	110	2,429
Carbon-Removing Compound (Methylene Chloride, Creosols, Phenols)	F001, F004	590	870	--	--
Highly Aromatic Naptha	D001	500	290	--	--
Methyl Ethyl Ketone	F005	285	525	--	1,050
Paint Remover	F005	200	540	--	--
Bromochloromethane	--	200	385	--	--
Sulfuric Acid	D002	25	25	--	--
Paint Thinner	D001	20	20	--	--
Ethanolamine and Benzyl Alcohol	D001	220	--	--	--
Oily Water and Cleaning Solutions Containing Lead, Cadmium, Chromium, and Nickel	D006, D007, D008	495	--	--	--
Hydraulic Fluid	--	0	360	--	--
Synthetic Oil	--	--	440	--	--
Inspection Penetrant	--	--	150	--	--
Organic Peroxide	D002	--	--	1	--
Spent Desiccant (Cobalt chloride) [a/]	--	50	40	10	--

[a/] Quantities for desiccant for all years are shown in pounds.

SECTION 4

DESCRIPTION OF INVESTIGATIONS

Early environmental investigations were conducted at the HWSA in 1988, 1990, and 1991. The activities conducted during, and the results of, these early investigations are presented in detail in the following documents: *Field Investigation Report* (ES, 1990), *Pre-Closure Sampling Report, Hazardous Waste Storage Area*, (ES, 1992b), *Addendum to the Pre-Closure Sampling Report, Hazardous Waste Storage Area*, (ES, 1992a), and Groundwater Survey October, 1991. A brief overview of the activities conducted during each of these investigation events is included here, and additional details from these documents are presented in Appendices A, B, and C. Additional fieldwork was conducted in February and March 1995 to evaluate the potential for naturally-occurring chemical attenuation processes to effect *in situ* remediation of residual dissolved contamination at the HWSA. These data are important to establish the role natural chemical attenuation may play in remediation/closure activities at the site. The results of this investigation, as are necessary to support the proposed closure approach, are presented in this amended closure/post closure plan. Additionally, data collected during groundwater sampling events in August 1995, December 1995, and March 1996 (Appendix E) are presented. These data are important to evaluate site-specific hydrogeologic conditions and observed trends in dissolved contamination that may be attributable to natural chemical attenuation processes.

4.1 PREVIOUS INVESTIGATIONS

During the investigations conducted from 1988 through 1991, surface soil, subsurface soil, and groundwater samples were collected and analyzed for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), and metals. The list of the analytes included in these sampling efforts is included in Table 4.1. A total of 15 boreholes were completed, 12 monitoring wells were installed, and 31 soil samples were collected during pre-closure sampling activities (ES, 1990; ES, 1992a; ES 1992b). The borings (including wells) ranged in depth from 10 to 27 feet bgs.

The analytical results from the investigations conducted prior to 1995 are compiled in tables included in Appendices A and B. Laboratory reports for the data are included in appendices of the pre-closure sampling reports (ES, 1992a and 1992b). The data are listed by depth of sample and by sample matrix. These analytical data are also illustrated on eight sheets that are contained in this amended closure/post closure plan. Sheets 1 through 5 illustrate results of analyses of soil samples by depth interval at the

TABLE 4.1
LIST OF TARGET ANALYTES FOR PREVIOUS INVESTIGATIONS (1989-1991)
HAZARDOUS WASTE STORAGE AREA
AMENDED CLOSURE/POST-CLOSURE PLAN
RICKENBACKER ANGB, OHIO

Base/Neutral Extractable Semivolatile Organic Compounds (USEPA Method SW 8270)	
Acenaphthene	Fluoranthene
Acenaphthylene	Fluorene
Anthracene	
	Hexachlorobenzene
Benzo(b)fluoranthene	Hexachlorobutadiene
Benzo(k)fluoranthene	Hexachloroethane
Benzo(a)pyrene	Hexachlorocyclopentadiene
Benzo(a)anthracene	
Benzo(ghi)perylene	Indeno(1,2,3-cd)pyrene
Benyl Alcohol *	Isophorone
Bis(2-chloroethyl)ether	
Bis(2-chloroethoxy)methane	Naphthalene
Bis(2-ethylhexyl)phthalate	Nitrobenzene
Bis(2-chloroisopropyl)ether	N-Nitrosodiphenylamine
4-Bromophenyl phenyl ether	2-Nitroaniline
Butylbenzlphthalate	3-Nitroaniline
	4-Nitroaniline
2-Chloronaphthalene	N-Nitroso-Dimethylamine *
4-Chloroaniline	N-Nitroso-di-n-dipropylamine
4-Chlorophenyl phenyl ether	
Chrysene	2-Methylnaphthalene
Dibenzo(a,h)anthracene	Phenanthrene
Dibenzofuran	Pyrene
Di-n-octylphthalate	
1,3-Dichlorobenzene	1,2,4-Trichlorobenzene
1,2-Dichlorobenzene	
1,4-Dichlorobenzene	
3,3'-Dichlorobenzidine	
Diethyl phthalate	
Dimethyl phthalate	
2,4-Dinitrotoluene	
2,6-Dinitrotoluene	
Di-n-octylphthalate	

TABLE 4.1 (CONTINUED)
LIST OF TARGET ANALYTES FOR PREVIOUS INVESTIGATIONS (1989-1991)
HAZARDOUS WASTE STORAGE AREA
AMENDED CLOSURE/POST-CLOSURE PLAN
RICKENBACKER ANGB, OHIO

Volatile Organic Compounds (USEPA Methods SW 8240/8260)	
Acrolein *	1,2-Dichloroethane
Acetone	trans-1,2-Dichloroethene
Acrylonitrile *	trans-1,3-Dichloropropene
Benzene	Ethylbenzene
Bromomethane	
Bromodichloromethane	2-Hexanone
Bromoform	
2-Butanone	Methylene Chloride
	4-Methyl-2-pentanone
Carbon disulfide	
Carbon tetrachloride	Styrene
Chlorobenzene	
Chloroethane	1,1,2,2-Tetrachloroethane
Chloroform	Tetrachloroethene
2-Chloroethyl vinyl ether *	Toluene
Chloromethane	1,1,1-Trichloroethane
	1,1,2-Trichloroethane
Dibromochloromethane	Trichloroethene
1,2-Dichloropropane	Trichlorofluoromethane *
1,3-Dichlorobenzene *	
cis-1,3-Dichloropropene	Vinyl chloride
1,2-Dichlorobenzene *	Vinyl Acetate *
1,4-Dichlorobenzene *	
1,1-Dichloroethene	Xylenes

Metals (USEPA Methods SW6010 and SW7470/7471)	
Antimony	Mercury
Arsenic	Nickel
Beryllium	Selenium
Cadmium	Silver
Chromium	Thallium
Copper	Zinc
Lead	

* These compounds are not on the Target Compound List (TCL) of the method but were included in the laboratory report.

site. Sheet 1 illustrates the results of the soil samples obtained from 0 to 2 feet bgs. Sheets 2 through 5 illustrate the results of soil samples obtained from 3 to 5 feet, 8 to 10 feet, 13 to 15 feet and greater than 15 feet bgs, respectively. Sheet 6 illustrates analytical results for VOCs and SVOCs in groundwater, and Sheet 7 illustrates analytical results for filtered metal analyses in groundwater. Sheet 8 illustrates all of the sample locations at the site, without the associated data. These data are used in Section ~~4.3.2~~**4.4.2** to describe the nature and extent of residual contamination at the site.

4.2 EARLY 1995 NATURAL CHEMICAL ATTENUATION INVESTIGATION

To determine if natural chemical attenuation processes are occurring at the HWSA, and if so, to evaluate whether these processes can play a significant role in groundwater remediation, additional data were necessary to evaluate near-surface geology, aquifer properties, and the nature and extent of soil and groundwater contamination. Site characterization activities included performing CPT with laser-induced fluorescence (LIF); sampling and analyzing soils from CPT pushes; installing groundwater monitoring points; sampling and analyzing groundwater from newly installed monitoring points and previously installed monitoring wells; and measuring and estimating hydrogeologic parameters (static groundwater levels, groundwater gradient, groundwater flow direction, and hydraulic conductivity). The field methods for all site activities are described in detail in the Draft Work Plan for a Treatability Study in Support of the Intrinsic Remediation (Natural Attenuation) Option at Site 1 (Hazardous Waste Storage Area), Rickenbacker ANGB (Parsons ES, 1995a). Sampling locations for the 1995 site activities are presented on Figure 4.1.

The objective of these field activities was to collect the following physical and chemical data:

- Depth from measurement datum to the water table or potentiometric surface in monitoring wells;
- Rate of change of water elevation following rapid depression or elevation of water level in a monitoring well (to be used to estimate hydraulic conductivity);
- Location of potential groundwater recharge and discharge areas;
- Stratigraphy of subsurface media;
- Nature and extent of residual petroleum and chlorinated aliphatic hydrocarbon contamination in soils;
- Total organic compound (TOC) in select soil samples.

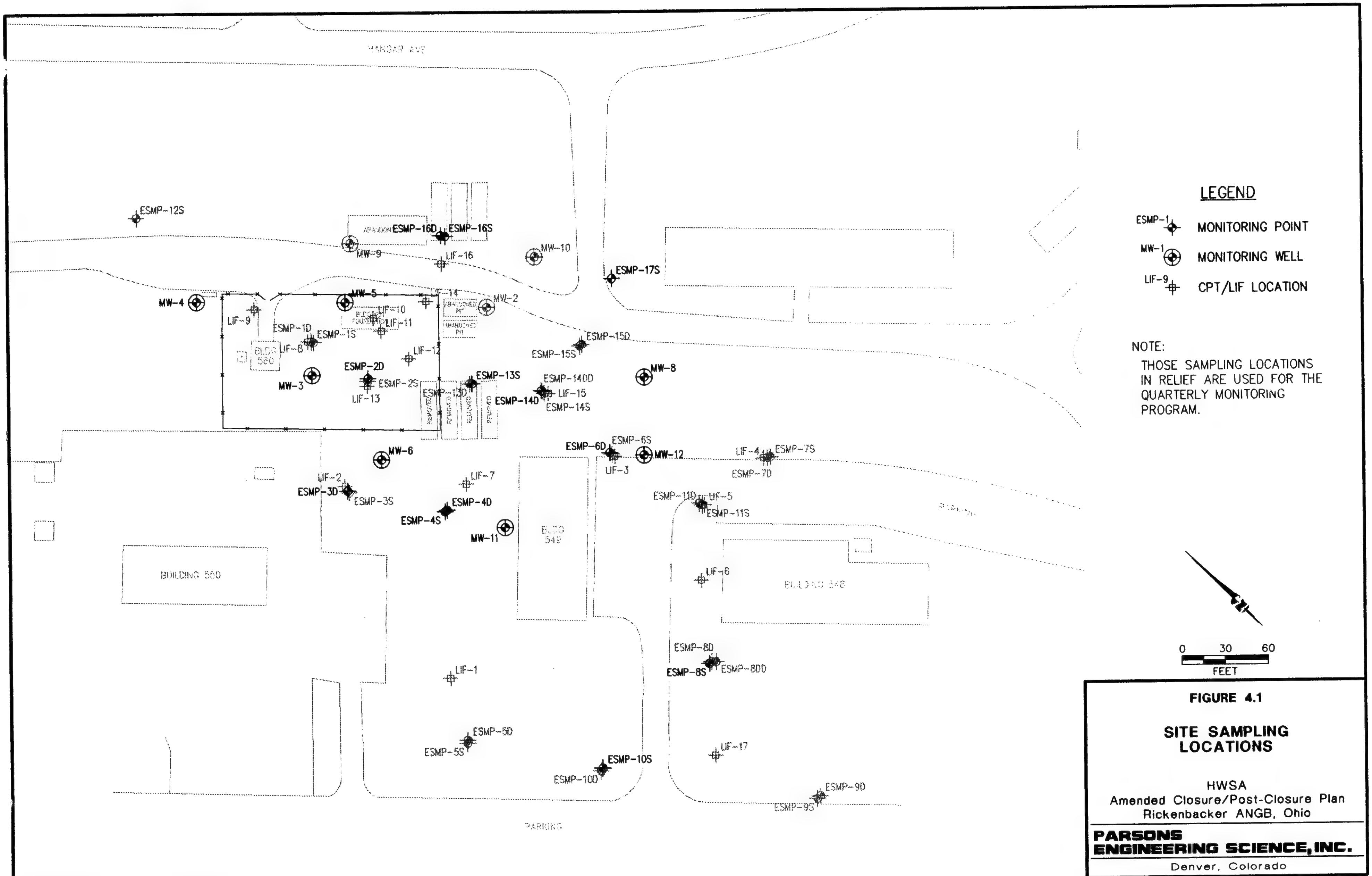


FIGURE 4.1

SITE SAMPLING LOCATIONS

HWSA
Amended Closure/Post-Closure Plan
Rickenbacker ANGB, Ohio

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

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- Nature and extent of benzene, toluene, ethylbenzene, and xylenes (BTEX), trimethylbenzene (TMB), total petroleum hydrocarbon (TPH), and chlorinated aliphatic hydrocarbons in groundwater;
- Concentrations of dissolved oxygen (DO), nitrate, ferrous iron, sulfate, methane, chloride, ammonia, and TOC in groundwater; and
- Temperature, specific conductance, reduction/oxidation (redox) potential, total alkalinity, and pH of groundwater.

An overview of these early 1995 site activities is presented in the following paragraphs. A more detailed discussion of field methods is provided in the work plan (Parsons ES, 1995a).

Subsurface conditions at the site were characterized by the US Army Corps of Engineers (USACE) and Parsons ES on February 21 through February 24, 1995, using a CPT coupled with a LIF testing device. Seventeen CPT pushes were performed at the locations labeled LIF-1 through LIF-17 (Figure 4.1). LIF was performed simultaneously at these locations to evaluate the presence of residual or mobile (free-phase) hydrocarbons in the soil and groundwater. The purpose of the CPT/LIF sampling at the site was to determine subsurface stratigraphy and to help delineate the extent of fluorescing contamination. Graphical results of each CPT/LIF push were plotted at the conclusion of each penetration and were available minutes after the completion of each hole. The graphs showed cone resistance, sleeve friction, soil classification, fluorescence intensity, and maximum fluoresced wavelength. The real-time availability of the CPT information allowed the USACE and Parsons ES to make investigative decisions based on the most current information. Final CPT logs are presented in Appendix C.

The CPT apparatus also was used to collect three undisturbed soil samples at three monitoring point locations. Sample SS-1 was collected from 10 to 10.7 feet bgs during the placement of monitoring point ESMP-14. Sample SS-2 was collected from 14 to 14.7 feet bgs during the placement of ESMP-16. Sample SS-3 was collected from 10 to 10.7 feet bgs adjacent to ESMP-12, following the placement of the monitoring point. Additional soil samples specified in the work plan (Parsons ES, 1995a) were not collected because the sampling attachments were broken during the sampling process.

Static groundwater levels were measured in all site wells prior to purging for groundwater sampling and at the conclusion of the field effort on March 1, 1995. Measurements were obtained at all site wells and monitoring points. Two rising head slug tests were performed on each of four monitoring wells: MW-4, MW-6, MW-9, and MW-12 (Figure 4.1).

Thirty-four 0.5-inch inside diameter (ID) groundwater monitoring points were installed at 17 locations in February to March 1995. Clusters of 3 monitoring points were installed at locations ESMP-8 and ESMP-14. Clusters of 2 monitoring points

were installed at locations ESMP-1, ESMP-2, ESMP-3, ESMP-4, ESMP-5, ESMP-6, ESMP-7, ESMP-9, ESMP-10, ESMP-11, ESMP-13, ESMP-15, and ESMP-16. Single monitoring points were installed at locations ESMP-12 and ESMP-17. Where monitoring points were installed in clusters, the shallowest screen was placed across or just below the observed water table. Screens for deeper monitoring points within the same cluster were placed approximately 7 to 10 feet below the next shallowest point in the cluster. At the locations with paired monitoring point clusters, the point with the shallowest screened interval was designated with the suffix "S", while the point with the deeper screened interval was designated with the suffix "D". At the locations with three monitoring points, the point with the shallowest screened interval was designated with the suffix "S", the point with the intermediate screened interval was designated with the suffix "D", and the deepest point in the cluster was labeled "DD". All installed monitoring points are shown on Figure 4.1. Those groundwater monitoring locations that are currently being used to conduct quarterly monitoring events are shown in relief. Completion details for the monitoring points and the existing monitoring wells are summarized in Table 4.2.

Two previously installed monitoring wells (MW-1 and MW-7) were destroyed during the 1995 removal of the USTs immediately prior to the field work conducted for this study. Groundwater samples were collected from the remaining 10 monitoring wells identified on Figure 4.1. Groundwater samples also were collected from 31 of the 34 newly installed 0.5-inch monitoring points. Samples were not collected from points ESMP-3S, ESMP-8D, and ESMP-11S because they produced an insufficient volume of groundwater. Groundwater was monitored for temperature and DO during purging. Groundwater samples were analyzed in the field by USEPA personnel for pH, conductivity, reduction/oxidation (redox) potential, total alkalinity, hydrogen sulfide, ferrous iron, chloride, sulfate, nitrogen, carbon dioxide, and ammonia. Results are not available for these field parameters from monitoring points ESMP-1S, ESMP-2S, ESMP-3S, ESMP-6S, ESMP-8S, ESMP-10S, ESMP-11S, ESMP-12S, and ESMP-14DD because sufficient groundwater could not be collected for these analyses. Sampling at monitoring points which were purged dry occurred after allowing time for groundwater to recover to approximately 90 percent of the initial water level. The volume from these points was enough to fill sample bottles for BTEX analysis but was generally insufficient to allow collection of a full suite of samples. Analyses for methane, ethene, fuel hydrocarbon compounds, and VOCs were performed at the USEPA's National Risk Management Research Laboratory (NRMRL) in Ada, Oklahoma. Free-phase hydrocarbons were encountered as mobile light non-aqueous-phase liquid (LNAPL) in monitoring well MW-5, and a sample of the product was collected for analysis of the mass fraction of BTEX.

All groundwater derived from purging and sampling was contained and transferred to 55-gallon drums. The drums were labeled with the date, contents, generation location, and generators. Drums were left onsite to be disposed of by the appropriate Base personnel.

TABLE 4.2
MONITORING POINT AND EXISTING WELL COMPLETION DETAILS
HAZARDOUS WASTE STORAGE AREA
AMENDED CLOSURE/POST-CLOSURE PLAN
RICKENBACKER ANGB, OHIO

Location	Installation Date	Easting	Northing	Datum Elevation (ft msl) [a/]	Ground Elevation (ft msl)	PVC Casing ID (inches)	Screen Length (feet)	Total Depth (ft btoc) [b/]	Depth to Top of Screen (ft btoc)	Depth to Base of Screen (ft btoc)
ESMP-1S	2/23/95	1845016	662614	741.67	741.60	0.50	3.28	11.70	8.42	11.70
ESMP-1D	2/23/95	1845015	662615	741.72	741.60	0.50	3.28	18.80	15.52	18.80
ESMP-2S	2/23/95	1845023	662568	741.18	741.20	0.50	3.28	11.42	8.14	11.42
ESMP-2D	2/23/95	1845025	662569	741.29	741.20	0.50	3.28	22.50	19.22	22.50
ESMP-3S	2/23/95	1844958	662524	742.23	741.80	0.50	3.28	12.55	9.27	12.55
ESMP-3D	2/23/95	1844959	662526	742.22	741.80	0.50	3.28	22.19	18.91	22.19
ESMP-4S	2/23/95	1844996	662467	742.70	742.60	0.50	3.28	12.58	9.30	12.58
ESMP-4D	2/23/95	1844997	662467	742.69	742.60	0.50	3.28	18.44	15.16	18.44
ESMP-5S	2/23/95	1844891	662345	741.51	741.50	0.50	3.28	12.51	9.23	12.51
ESMP-5D	2/23/95	1844893	662346	741.56	741.50	0.50	3.28	22.54	19.26	22.54
ESMP-6S	2/23/95	1845105	662411	740.98	741.00	0.50	3.28	15.80	12.52	15.80
ESMP-6D	2/23/95	1845105	662412	741.05	741.00	0.50	3.28	23.51	20.23	23.51
ESMP-7S	2/23/95	1845181	662330	740.85	740.80	0.50	3.28	11.75	8.47	11.75
ESMP-7D	2/23/95	1845179	662331	740.80	740.80	0.50	3.28	23.59	20.31	23.59
ESMP-8S	2/23/95	1845049	662261	740.92	740.80	0.50	3.28	10.72	7.44	10.72
ESMP-8D	2/23/95	1845050	662261	740.89	740.90	0.50	3.28	22.81	19.53	22.81
ESMP-8DD	2/23/95	1845052	662259	740.83	740.80	0.50	3.28	29.74	26.46	29.74
ESMP-9S	2/23/95	1845034	662143	741.79	741.60	0.50	3.28	11.81	8.53	11.81
ESMP-9D	2/23/95	1845036	662143	741.70	741.60	0.50	3.28	21.85	18.57	21.85
ESMP-10S	2/23/95	1844945	662265	741.56	741.50	0.50	3.28	15.84	12.56	15.84
ESMP-10D	2/23/95	1844942	662265	741.54	741.50	0.50	3.28	22.07	18.79	22.07
ESMP-11S	2/23/95	1845124	662341	740.76	740.80	0.50	3.28	15.78	12.50	15.78
ESMP-11D	2/23/95	1845123	662343	740.80	740.80	0.50	3.28	22.82	19.54	22.82
ESMP-12S	2/24/95	1844991	662762	741.43	741.30	0.50	3.28	15.73	12.45	15.73

TABLE 4.2 (Continued)
MONITORING POINT AND EXISTING WELL COMPLETION DETAILS
HAZARDOUS WASTE STORAGE AREA
AMENDED CLOSURE/POST-CLOSURE PLAN
RICKENBACKER ANGB, OHIO

Location	Installation Date	Easting	Northing	Datum Elevation (ft msl)[a]	Ground Elevation (ft msl)	PVC Casing ID (inches)	Screen Length (feet)	Total Depth (ft btoc)[b]	Depth to Top of Screen (ft btoc)	Depth to Base of Screen (ft btoc)
ESMP-13S	2/24/95	1845072	662515	741.38	741.40	0.50	3.28	16.18	12.90	16.18
ESMP-13D	2/24/95	1845071	662515	741.38	741.40	0.50	3.28	21.48	18.20	21.48
ESMP-14S	2/24/95	1845102	662475	741.17	741.40	0.50	3.28	17.70	14.42	17.70
ESMP-14D	2/24/95	1845103	662474	741.18	741.00	0.50	3.28	24.58	21.30	24.58
ESMP-14DD	2/24/95	1845103	662476	741.13	741.00	0.50	3.28	29.71	26.43	29.71
ESMP-15S	2/24/95	1845143	662479	740.37	740.20	0.50	3.28	17.52	14.24	17.52
ESMP-15D	2/24/95	1845145	662478	740.28	740.20	0.50	3.28	24.90	21.62	24.90
ESMP-16S	2/24/95	1845132	662598	740.33	740.30	0.50	3.28	15.57	12.29	15.57
ESMP-16D	2/24/95	1845130	662601	740.33	740.30	0.50	3.28	22.65	19.37	22.65
ESMP-17S	2/24/95	1845192	662495	739.87	739.90	0.50	3.28	15.62	12.34	15.62
MW-2	7/29/88	1845118	662544	743.36	741.10	2	10	16.91	6.91	16.91
MW-3	8/10/88	1844999	662599	743.96	741.60	2	10	20.10	10.10	20.10
MW-4	1/29/90	1844979	662691	745.15	741.80	2	10	18.30	8.30	18.30
MW-5	1/31/90	1845051	662617	744.97	741.60	2	10	18.04	8.04	18.04
MW-6	1/30/90	1844991	662524	745.18	741.70	2	10	17.99	7.99	17.99
MW-8	1/30/90	1845159	662431	743.89	740.40	2	10	18.44	8.44	18.44
MW-9	2/9/90	1845083	662643	745.25	741.60	2	10	18.27	8.27	18.27
MW-10	10/14/91	1845165	662544	742.64	740.30	2	10	20.16	10.16	20.16
MW-11	10/15/91	1845017	662429	744.15	741.40	2	10	19.77	9.77	19.77
MW-12	10/15/91	1845120	662394	743.02	740.80	2	10	20.06	10.06	20.06

[a] ft msl = feet above mean sea level.

[b] ft btoc = feet below top of casing.

4.3 1995/1996 GROUNDWATER MONITORING EVENTS

IT Corporation (1996) collected field and analytical data in August 1995, December 1995, and March 1996 to compare against data collected in February/March 1995 as part of the natural chemical attenuation investigation. These data may be particularly useful in evaluating contaminant trends over time, as well as identifying physical site conditions that may impact the effectiveness of natural chemical attenuation processes. Groundwater wells sampled as part of these monitoring events are shown in relief on Figure 4.1.

4.4 SUMMARY OF SITE CONDITIONS

4.4.1 Geology and Hydrogeology

Site geology and hydrogeology has been characterized from data compiled from all site investigations. These data consisted of stratigraphic information recorded during borehole/monitoring well installation and CPT investigations as well as hydrogeologic data such as water level measurements and slug tests.

Twelve monitoring wells and 15 soil borings were completed at the HWSA during pre-closure sampling activities. The borings (including wells) ranged in depth from 10 to 27 feet bgs. Soil from the ground surface down to 8 feet bgs consists of a medium-brown, silty clay, with trace amounts of pebbles. This unit grades into a grayish silty clay till present from 8 to 14 feet bgs, with moisture encountered at 10 feet bgs. This moist, silty clay layer is immediately underlain by the shallow water-bearing zone. Wet, fine to medium-grained, brown, sandy gravel is present from 14 to 18 feet bgs. The water-bearing zone has some interbedded thin layers of fine, well-sorted brown sands and fine- to medium-grained gray sandy gravel. Upon equilibration in most monitoring wells, the static water level was approximately 10 feet bgs. The shallow water-bearing zone is separated from a second water-bearing zone by a ~~confining~~ layer of hard, dense gray clay from 18 to 19 feet bgs. Immediately below this ~~confining~~ layer is a 6-foot-thick fine to medium-grained gray, sandy gravel interbedded with thin layers of fine-grained, well-sorted brown sands and dense gray clays. Whether these sand layers represent two distinct water-bearing zones or become one continuous unit away from the HWSA is unknown. The 6-foot-thick sand and gravel interval is underlain by a hard dense gray clay to at least 27 feet bgs (cross-section B-B', Appendix B).

Soil boreholes elsewhere on the Base penetrated over 40 feet of silty clay soil beneath the stratigraphic unit represented by the second water-bearing zone. This clay unit acts as a barrier to vertical migration of contaminants toward the aquifer formerly used for the Base water supply, which is more than 100 feet bgs.

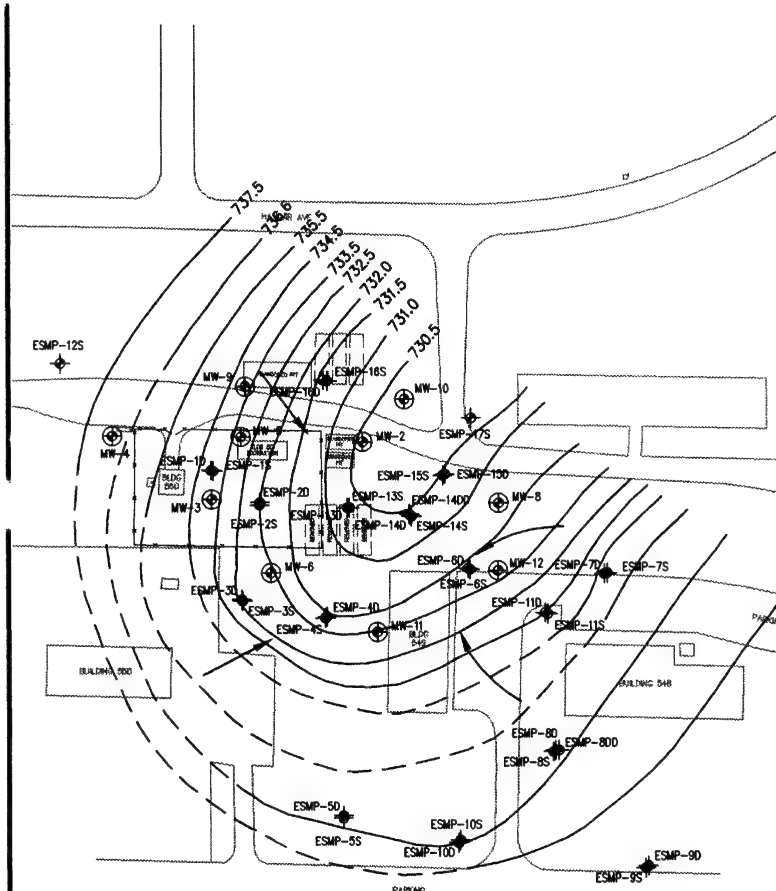
Groundwater is confined in the sand aquifer by the till layer and generally attains a static level of approximately 10 feet bgs in the monitoring wells. The groundwater potentiometric surface as interpreted from the water level measurements collected in

1990 from the monitoring wells is illustrated in Figure B.3, in Appendix B. On the basis of these data, the groundwater flow direction was previously interpreted as being toward the southeast, with a gradient of approximately 0.02 foot per foot (ft/ft). The *Pre-Closure Sampling Report* and the *Addendum to the Pre-Closure Sampling Report* (Engineering-Science, Inc., 1992a and 1992b) present further discussion of site hydrogeology.

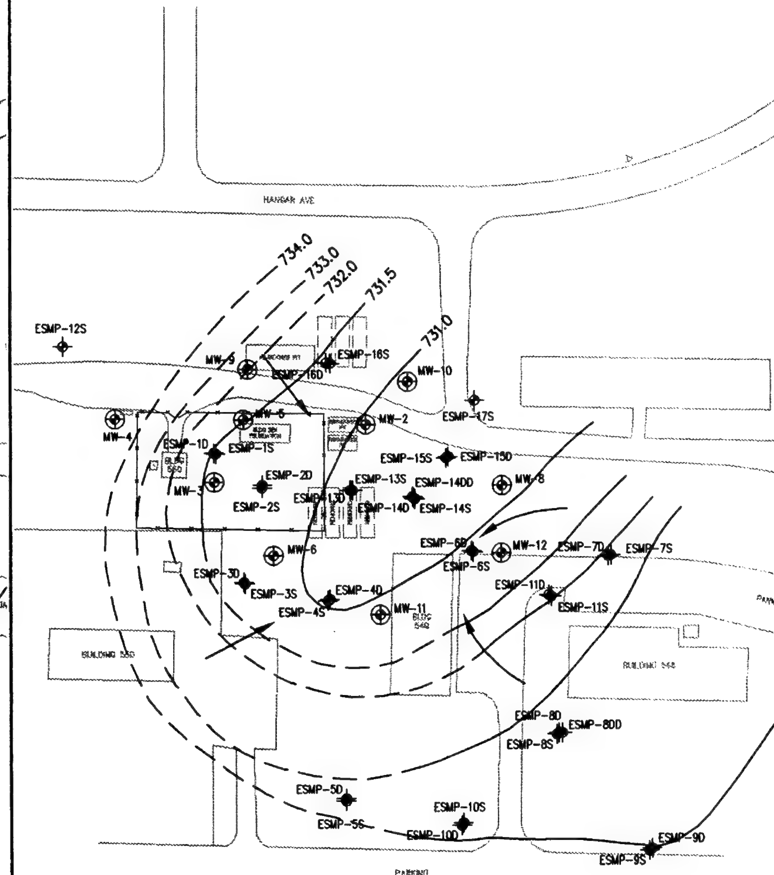
The monitoring points installed in February 1995 provide greater areal coverage than was previously available. Various interpretations of groundwater elevation data collected in 1995 and 1996 implied a localized groundwater depression in the vicinity of the HWSA. IT Corporation (1996) recognized that accurate potentiometric surface maps could not be prepared using data collected at monitoring points/wells screened across geologically dissimilar units. Although it is inappropriate to use only monitoring wells to construct a potentiometric surface map (IT Corporation, 1996), available data from sampling locations screened across hydrogeologically similar units can be used. Specifically, sampling points or wells screened across the gray silty clay unit (about 8 to 14 feet bgs) can be expected to have groundwater elevations that differ from the underlying sandy gravel. Although the groundwater table occurs at approximately 10 feet bgs, the gray silty clays are less permeable than deeper water-bearing units. Sampling points or wells screened across the sandy gravel unit (about 14 to 18 feet bgs) are believed to be within the shallow, more permeable flow zone. These wells also would be expected to yield sufficient water to permit purging and sampling, as evidenced by recent sampling events (IT Corporation, 1996). Sampling points or wells screened below the thin dense clay layer in the sandy, gray clays occurring below 19 feet bgs also may exhibit different flow characteristics than encountered in shallower units. Those sampling points or wells screened across two different units are likely to reflect hydrogeologic characteristics similar to the more permeable zone.

Figures 4.2 through 4.4 present the potentiometric surface maps constructed from data collected at both shallow- and deep-screened sampling locations in March 1995, December 1995, and March 1996. The data generally suggest a potential preferential flow path toward the northeast. However, additional data from the northeast and southwest are necessary to verify this conclusion. **Additional assessment activities will be undertaken at the site to address this issue, particularly as it relates to optimizing final remedial design and establishing long-term closure objectives.** Contaminant distribution data presented in subsequent discussions further support this interpretation.

Hydraulic conductivities were estimated from the rising head slug tests conducted in early 1995; the results are summarized in Table 4.3. Values for the hydraulic conductivity ranged from 0.13 feet per day (ft/day) to 2.79 ft/day. The average hydraulic conductivity at the HWSA, as determined from these tests, is 1.03 ft/day. Using a reported hydraulic gradient of 0.02 ft/ft and assuming an effective porosity of about 0.3, the linear advective velocity of groundwater at the HWSA is about 25 feet



SHALLOW MONITORING POINTS SCREENED FROM ~8 - 12 ft bgs



DEEP MONITORING POINTS SCREENED FROM ~15 - 22 ft bgs

LEGEND

ESMP-1 MONITORING POINT

MW-1 MONITORING WELL

—731— LINE OF EQUAL GROUNDWATER ELEVATION, (DASHED WHERE INFERRED)

GROUNDWATER FLOW DIRECTION

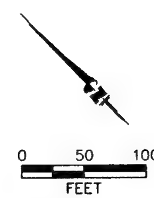


FIGURE 4.2

GROUNDWATER POTENTIOMETRIC SURFACE MARCH 1995

HWSA
Amended Closure/Post-Closure Plan
Rickenbacker ANGB, Ohio

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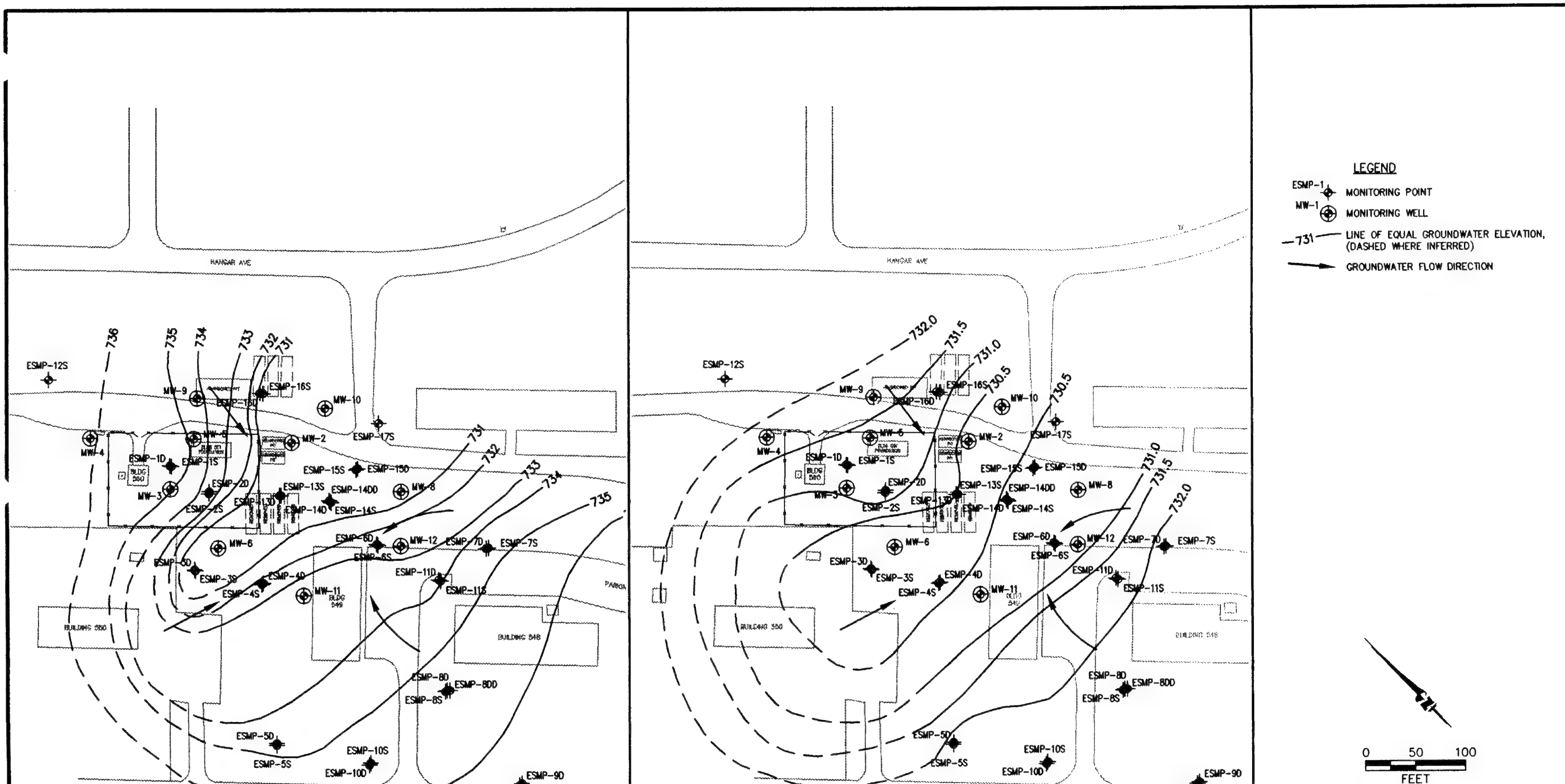

FIGURE 4.3

GROUNDWATER POTENTIOMETRIC SURFACE DECEMBER 1995

HWSA
Amended Closure/Post-Closure Plan
Rickenbacker ANGB, Ohio

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

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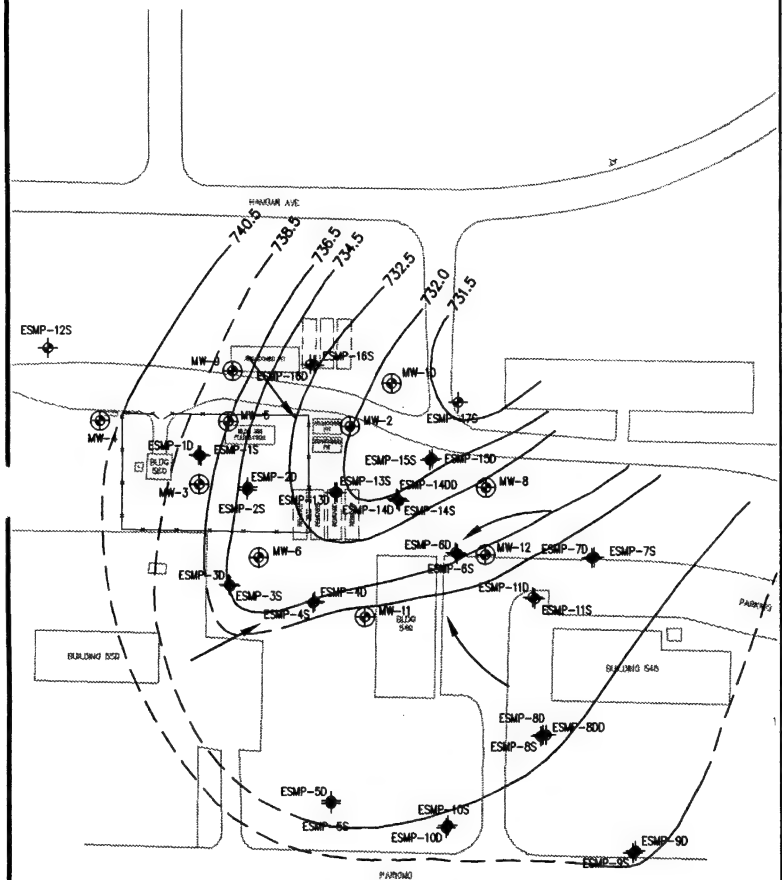
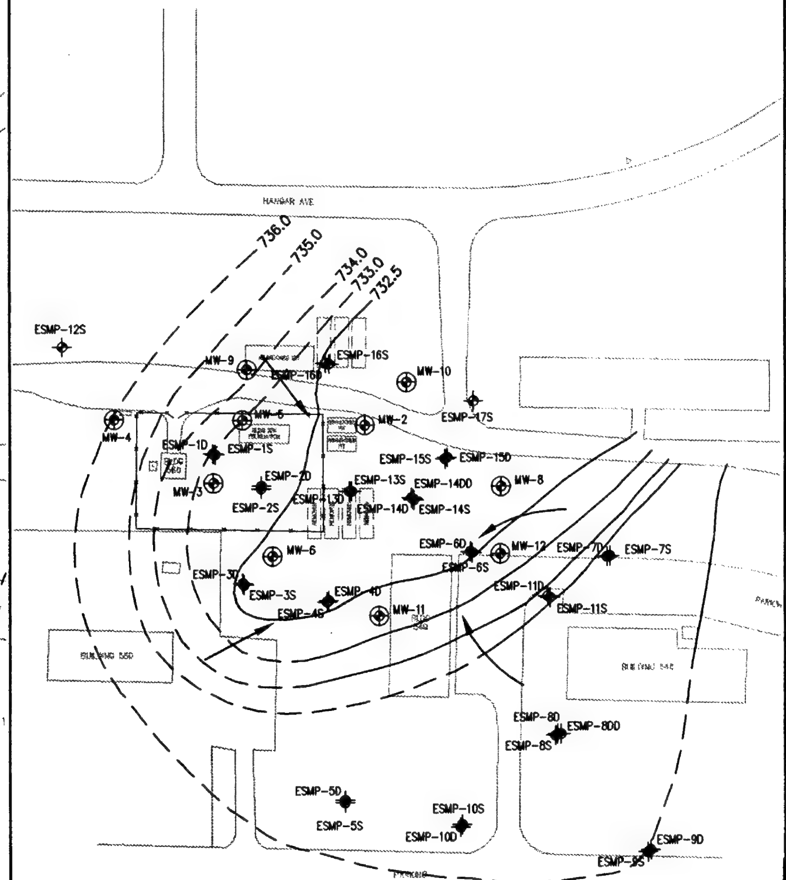


SHALLOW MONITORING POINTS SCREENED FROM ~8 - 12 ft bgs



DEEP MONITORING POINTS SCREENED FROM ~15 - 22 ft bgs

FIGURE 4.4

GROUNDWATER POTENTIOMETRIC SURFACE MARCH 1996

HWSA
Amended Closure/Post-Closure Plan
Rickenbacker ANGB, Ohio

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

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TABLE 4.3

HYDRAULIC CONDUCTIVITY (K) VALUES FROM SLUG TESTS, MARCH 1995
HAZARDOUS WASTE STORAGE AREA
AMENDED CLOSURE/POST-CLOSURE PLAN
RICKENBACKER ANGB, OHIO

Well	K (ft/min)	K (ft/day)
MW-4	5.23E-04	0.75
MW-4	4.59E-04	0.66
MW-6	1.94E-03	2.79
MW-6	9.01E-04	1.30
MW-9	8.77E-04	1.26
MW-9	6.56E-04	0.94
MW-12	9.88E-05	0.14
MW-12	8.98E-05	0.13

Average K	7.17E-04	1.03
Minimum K	8.98E-05	0.13
Maximum K	1.94E-03	2.79

per year (ft/yr). In comparison, IT Corporation (1996) estimated linear groundwater velocity at the site to range from less than 3.6 to about 33 ft/yr.

4.4.2 Extent of Contamination

4.4.2.1 Soil

The network of boreholes and wells has defined the extent of soil contamination attributable to HWSA operations. Analytical data for the investigations prior to 1995 are summarized in Appendices A and B. Results of previous investigations at the HWSA indicate that VOCs, SVOCs, and metals are present in the surface and subsurface soils at the site.

The network of borings and wells installed before 1995 defined the extent of soil contamination potentially attributable to HWSA operations. The horizontal extent of VOCs in soil is defined by the non-detect results for MW-4, MW-10, MW-11, and MW-12 (see attached sheets). The vertical extent of VOCs in soil was defined by soil borings AB11, AB12, AB14, and AB15. VOCs were initially detected in only two of the deeper, saturated soil samples: benzene was detected at 6 micrograms per kilogram (μg/kg) at 21-23 feet bgs, and trichloroethene (TCE) was detected at 4J μg/kg at 25-27 feet bgs.

Because the extent of shallow SVOC soil contamination extends beyond HWSA boundaries at the southwest corner, this contamination probably originated offsite. This conclusion is based upon the occurrence of the highest SVOC concentrations in soil samples SS-3 and SS-4 collected outside the site fence near the western corner of the HWSA (see attached sheets). However, the vertical extent of SVOC soil contamination is similar to that defined for VOCs in soil. No SVOCs were detected in soil samples collected from below 20 feet bgs.

Background sampling for metals in soils was conducted during previous site investigations for the IRP. Seven sampling locations were used to determine background metals concentrations. The extent of metals in soils at the site was defined by the network of borings and surface soils samples. Metal concentrations in excess of established background concentrations were detected sporadically in soil samples from the HWSA (see attached sheets). Table 4.4 presents a comparison of the detected concentrations of metals in onsite soils to USEPA (1994б) soil screening levels (SSLS) established for the residential exposure scenario. A few of the detected compounds exceed those levels designed to be protective of onsite residents via incidental ingestion of soil (arsenic, beryllium) and leaching from soils into onsite groundwater used as a potable water source (arsenic, cadmium, chromium, nickel, and thallium). The residential exposure scenario is not proposed to reflect current or reasonable future land use scenarios for the HWSA.

Possible sources of nonsite-related contaminants are a former coal-fired power plant and coal storage pile west of the site, and the maintenance storage area southwest of the

TABLE 4.4
COMPARISON OF METALS DETECTED IN SOIL TO USEPA SOIL SCREENING LEVELS (SSLs)
HAZARDOUS WASTE STORAGE AREA
AMENDED CLOSURE/POST-CLOSURE PLAN
RICKENBACKER ANGB, OHIO

Compound	Soil Interval (feet bgs)	Detected Range (mg/kg/)	Pathway-specific values for surface soils (mg/kg)		Migration to groundwater pathway levels (mg/kg)
			Ingestion	Inhalation	With 10 DAF
Arsenic	0-2	15.6 - 42	0.4[a]	380[a]	15[b]
Beryllium	0-2	0.39 - 0.96	0.1[a]	690[a]	180[b]
Cadmium	0-2	0.37 - 9.1	39[c]	920[a]	6[b]
Copper	0-2	45.3 - 73.1	2,900[d]	-[e]	-
Lead	0-2	22.4 - 187	400[f]	-	-
Mercury	0-2	2.6	23[c]	7[b,c]	3[b]
Nickel	0-2	60	1,600[c]	6,900[a]	21[b]
Silver	0-2	1.8 - 7.2	390[c]	-	-
Zinc	0-2	179 - 522	23,000[c]	-	42,000[b,c]
Arsenic	3-5	16.8 - 29	0.4[a]	380[a]	15[b]
Beryllium	3-5	0.45 - 1.0	0.1[a]	690[a]	180[b]
Cadmium	3-5	0.35 - 6.9	39[c]	920[a]	6[b]
Copper	3-5	49.3	2,900[d]	-	-
Chromium	3-5	28.6	390[c]	140[a]	19[b]
Lead	3-5	20.7 - 382	400[f]	-	-
Thallium	3-5	1.1 - 1.2	-	-	0.4[b]
Zinc	3-5	166	23,000[c]	-	42,000[b,c]
Arsenic	8-10	15.7 - 26	0.4[a]	380[a]	15[b]
Beryllium	8-10	0.54 - 0.79	0.1[a]	690[a]	180[b]
Cadmium	8-10	0.33 - 0.55	39[c]	920[a]	6[b]
Lead	8-10	22.8	400[f]	-	-
Selenium	8-10	1.7	390[c]	-	3[b]
Thallium	8-10	10.5	-	-	0.4[b]
Arsenic	13-15	15.8	0.4[a]	380[a]	15[b]
Beryllium	13-15	0.67 - 0.75	0.1[a]	690[a]	180[b]
Cadmium	13-15	0.37 - 0.72	39[c]	920[a]	6[b]
Copper	13-15	38.5 - 57.4	2,900[d]	-	-
Lead	13-15	25.5 - 37	400[f]	-	-
Mercury	13-15	0.096	23[c]	7[b,c]	3[b]
Arsenic	14-16	16.9	0.4[a]	380[a]	15[b]
Copper	15-17	51.3	2,900[d]	-	-

TABLE 4.4
COMPARISON OF METALS DETECTED IN SOIL TO USEPA SOIL SCREENING LEVELS (SSLs)
HAZARDOUS WASTE STORAGE AREA
AMENDED CLOSURE/POST-CLOSURE PLAN
RICKENBACKER ANGB, OHIO

Compound	Soil Interval (feet bgs)	Detected Range (mg/kg/)	Pathway-specific values for surface soils (mg/kg)		Migration to groundwater pathway levels (mg/kg)
			Ingestion	Inhalation	With 10 DAF
Copper	17-19	42.8	2,900[d]	-	-
Mercury	17-19	0.17	23[c]	7[b,c]	3[b]
Arsenic	21-23	61.2	0.4[e]	380[e]	15[i]
Copper	21-23	42.9 - 46	2,900[d]	-	-
Mercury	21-23	0.087	23[c]	7[b,c]	3[b]
Beryllium	25-27	0.72	0.1[a]	690[a]	180[b]
Mercury	25-27	0.16	23[c]	7[b,c]	3[b]

a/ Calculated values correspond to a cancer risk level of 1 in 1,000,000.

b/ SSL for pH of 6.8.

c/ Calculated values correspond to a noncancer hazard quotient of 1.

d/ Calculated using EPA SSL Guidance, 1996 ingestion equation using the Heast value for the essential nutrient copper.

e/ No toxicity criteria available for that route of exposure.

f/ A preliminary remediation goal of 400 mg/kg has been set for lead based on Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities, OWSER Directive #9355.4-12, Office of Solid Waste and Emergency Response, U.S. EPA, Washington, DC, July 14, 1994.

NOTE: Arsenic, cadmium, mercury, nickel, selenium, and zinc have the potential for soil-plant-human exposure.

Source: USEPA Soil Screening Guidance, 1996.

site. The association of SVOCs and metals is common in contamination from the outfall of coal burning. The HWSA is downwind of the coal-fired boiler smokestack and storage pile and the contaminants are believed to originate from the coal burning and storage.

4.4.2.2 Groundwater

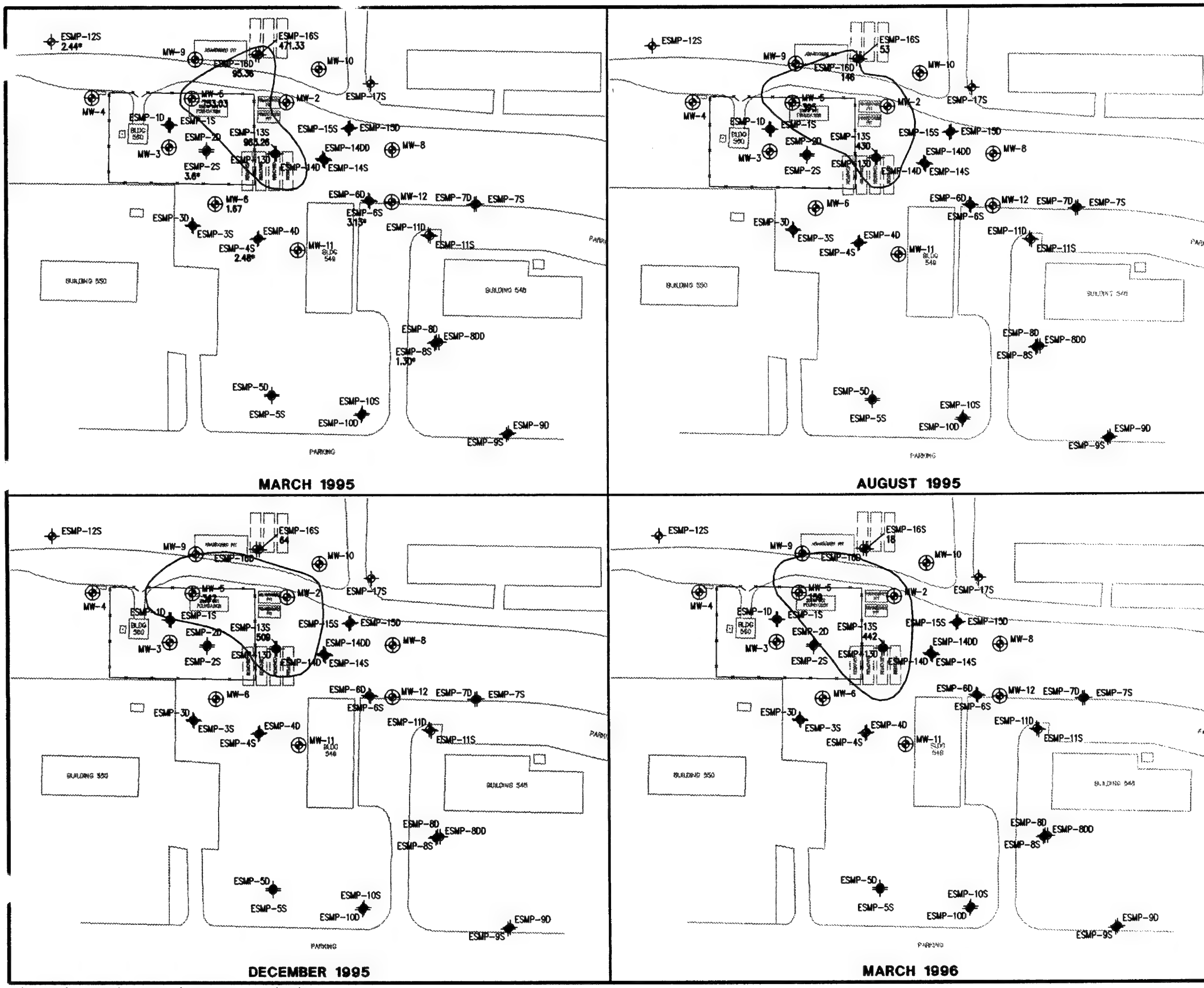
The horizontal extent of VOCs in groundwater prior to 1995 was defined by the nondetect results obtained for water samples from groundwater screening and groundwater results for MW-4, MW-9, MW-10, MW-11 and MW-12, and by the very low concentrations of VOCs detected in groundwater samples from MW-8 (Sheet 6).

The elevated concentrations of chlorinated VOCs in the groundwater may indicate that residual non-aqueous-phase liquids (NAPLs) may be present at the HWSA. The highest concentration of a compound denser than water detected in groundwater prior to 1995 was 2,000 micrograms per liter (μg/L) of TCE. This concentration was measured at MW-6 (Appendix A, p. A-14; Sheet 5). A higher concentration of TCE (9,580 μg/L) was detected in this well in 1995. Concentrations of compounds must be within about 1 percent of the solubility limit of that compound before the presence of NAPL would be suspected (USEPA, 1993). The solubility of TCE is 1,100,000 μg/L; therefore, the concentration of TCE would need to approach about 11,000 μg/L before a NAPL source was suspected. The solubility limits for other compounds present at the site are shown in Appendix A, Table A.1.

Groundwater samples were collected from the 10 remaining monitoring wells and from 31 of the 34 monitoring points installed in February 1995. Groundwater samples also were collected from 19 monitoring wells and points in August 1995, December 1995, and March 1996 as part of the quarterly groundwater monitoring program (IT Corporation, 1996). The results of the analyses performed on these samples are discussed in the following sections both to further define the extent of contamination and to document the potential for natural chemical attenuation.

The areal distribution of dissolved BTEX in groundwater for February/March 1995, August 1995, December 1995, and March 1996 is presented on Figure 4.5. There are several samples from monitoring wells or monitoring points that contained low concentrations (<5 μg/L) of BTEX compounds that are not included in the extent of the plume as illustrated in Figure 4.5. These data points are not included in the extent of the plume because they are below regulatory groundwater standards. The results of analyses performed on samples collected on all of these samples are summarized in Table 4.5. Laboratory reports are included in Appendices D and E.

The maximum observed total BTEX concentration in February/March 1995 was 963.26 μg/L in the sample collected from monitoring point ESMP-13S. This sample also exhibited the highest observed benzene concentration of 424.18 μg/L. The vertical extent at this location was defined by the sample collected from ESMP-13D where total



LEGEND

ESMP-1 MONITORING POINT

MW-1 MONITORING WELL

LIF-9 CPT/LIF LOCATION

0 30 60 120
FEET

FIGURE 4.5

ESTIMATED EXTENT OF TOTAL BTEX CONCENTRATIONS >5 μg/L IN GROUNDWATER

HWSA
Amended Closure/Post-Closure Plan
Rickenbacker ANGB, Ohio

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

K:\AFCEE\722450\RCKBCKR\96DN0910, 10/03/96 at 17:30

TABLE 4.5
BTEX AND CHLORINATED VOCs DETECTED IN GROUNDWATER
FEBRUARY-MARCH, 1995
HAZARDOUS WASTE STORAGE AREA
AMENDED CLOSURE/POST-CLOSURE PLAN
RICKENBACKER ANGB, OHIO

Sample Location	Sample Date	Benzene (µg/L)	Toluene (µg/L)	Ethylbenzene (µg/L)	p-Xylene (µg/L)	m-Xylene (µg/L)	o-Xylene (µg/L)	Total Xylenes (µg/L)	Total BTEX (µg/L)	Vinyl Chloride (µg/L)	1,1-DCE (µg/L)	T-1,2-DCE (µg/L)	C-1,2-DCE (µg/L)	1,2-DCA (µg/L)	TCE (µg/L)	PCE (µg/L)
ESMP-1S	2/28/95	ND[a]	BLQ[b]	ND	ND	ND	ND	ND	BLQ	ND	ND	ND	ND	ND	ND	ND
ESMP-1D	2/28/95	ND	BLQ	BLQ	ND	ND	ND	ND	BLQ	ND	ND	ND	ND	ND	ND	ND
ESMP-2S	2/28/95	NA[c]	NA	NA	NA	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND
ESMP-2D	2/28/95	ND	1.05	ND	ND	ND	ND	ND	1.05	ND	ND	1.00	BCL[d]	ND	95.60	ND
ESMP-2D	8/1/95	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	20.00	ND
ESMP-2D	12/1/95	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	14.00	ND
ESMP-2D	3/1/96	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	9.00	ND
ESMP-3S	2/28/95	NA	NA	NA	NA	NA	NA	NA	NA	ND	ND	ND	BCL	ND	1.00	ND
ESMP-3D	2/28/95	ND	BLQ	ND	ND	ND	ND	ND	BLQ	ND	ND	ND	1.30	ND	6.50	ND
ESMP-3D	8/1/95	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ESMP-3D	12/1/95	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ESMP-3D	3/1/96	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ESMP-4S	2/28/95	ND	BLQ	ND	ND	ND	ND	ND	BLQ	1.00	ND	ND	ND	ND	ND	ND
ESMP-4S	8/1/95	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ESMP-4S	12/1/95	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ESMP-4S	3/1/96	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ESMP-4D	2/28/95	ND	2.48	ND	ND	ND	ND	ND	2.48	16.00	ND	ND	ND	ND	ND	ND
ESMP-4D	8/1/95	ND	ND	ND	ND	ND	ND	ND	ND	15.00	ND	ND	ND	ND	ND	ND
ESMP-4D	12/1/95	ND	ND	ND	ND	ND	ND	ND	ND	15.00	ND	ND	ND	ND	ND	ND
ESMP-4D	3/1/96	ND	ND	ND	ND	ND	ND	ND	ND	19.00	ND	ND	ND	ND	ND	ND
ESMP-5S	2/27/95	ND	BLQ	BLQ	BLQ	ND	ND	BLQ	BLQ	ND	ND	ND	ND	ND	ND	ND
ESMP-5D	2/27/95	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ESMP-6S	2/28/95	ND	3.13	ND	ND	ND	ND	ND	3.13	NA	NA	NA	NA	NA	NA	NA
ESMP-6D	2/28/95	ND	BLQ	ND	ND	ND	ND	ND	BLQ	1.70	ND	ND	ND	ND	ND	ND
ESMP-6D(D)	2/28/95	NA	NA	NA	NA	NA	NA	NA	NA	2.00	ND	ND	ND	ND	ND	ND
ESMP-6D	8/1/95	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ESMP-6D	12/1/95	ND	ND	ND	ND	ND	ND	ND	ND	2.00	ND	ND	ND	ND	ND	ND
ESMP-6D	3/1/96	ND	ND	ND	ND	ND	ND	ND	ND	1.9 J	ND	ND	ND	ND	ND	ND
ESMP-7S	2/28/95	BLQ	BLQ	ND	ND	ND	ND	ND	BLQ	ND	ND	ND	ND	ND	ND	ND
ESMP-7D	2/28/95	BLQ	BLQ	BLQ	BLQ	ND	ND	BLQ	0.00	ND	ND	ND	ND	ND	ND	ND
ESMP-8S	2/27/95	ND	1.30	ND	ND	ND	ND	ND	BLQ	ND	ND	ND	ND	ND	BCL	ND
ESMP-8S	8/1/95	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ESMP-8S	12/1/95	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ESMP-8S	3/1/96	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ESMP-8D(D)	2/27/95	ND	BLQ	ND	ND	BLQ	ND	BLQ	BLQ	ND	ND	ND	ND	ND	BCL	ND
ESMP-9S	2/28/95	ND	BLQ	BLQ	ND	ND	ND	ND	BLQ	ND	ND	ND	ND	ND	BCL	ND
ESMP-9D	2/28/95	ND	BLQ	ND	ND	BLQ	ND	BLQ	ND	ND	ND	ND	ND	ND	ND	ND
ESMP-10S	2/27/95	ND	BLQ	ND	BLQ	BLQ	ND	BLQ	BLQ	ND	ND	ND	ND	ND	1.00	ND
ESMP-10S(D)	2/27/95	NA	NA	NA	NA	NA	NA	NA	NA	ND	ND	ND	ND	ND	1.00	ND
ESMP-10S(D)	8/1/95	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ESMP-10S(D)	12/1/95	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ESMP-10S(D)	3/1/96	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

TABLE 4.5
BTEX AND CHLORINATED VOCs DETECTED IN GROUNDWATER
FEBRUARY-MARCH, 1995
HAZARDOUS WASTE STORAGE AREA
AMENDED CLOSURE/POST-CLOSURE PLAN
RICKENBACKER ANGB, OHIO

Sample Location	Sample Date	Benzene (µg/L)	Toluene (µg/L)	Ethylbenzene (µg/L)	p-Xylene (µg/L)	m-Xylene (µg/L)	o-Xylene (µg/L)	Total Xylenes (µg/L)	Total BTEX (µg/L)	Vinyl Chloride (µg/L)	1,1-DCE (µg/L)	T-1,2-DCE (µg/L)	C-1,2-DCE (µg/L)	1,2-DCA (µg/L)	TCE (µg/L)	PCE (µg/L)
ESMP-10D	2/27/95	ND	BLQ	ND	ND	ND	ND	ND	BLQ	ND	ND	ND	ND	ND	ND	ND
ESMP-11D	2/27/95	BLQ	BLQ	BLQ	BLQ	ND	ND	BLQ	BLQ	ND	ND	ND	ND	ND	ND	ND
ESMP-12S	3/1/95	ND	2.44	BLQ	ND	ND	ND	ND	2.44	ND	ND	ND	ND	220.00	BCL	ND
ESMP-13S	2/28/95	424.18	22.41	237.09	106.99	163.61	8.98	279.58	963.26	2.7	1.3	300	228	ND	45.6	ND
ESMP-13S	8/1/95	200.00	ND	130.00	NA	NA	NA	100.00	430.00	ND	ND	430.00	ND	ND	ND	ND
ESMP-13S	12/1/95	270.00	8.9 J	140.00	ND	ND	ND	90.00	509.00	ND	ND	410.00	ND	ND	ND	ND
ESMP-13S	3/1/96	280.00	8.2 J	120.00	ND	ND	ND	34.00	440.00	62.00	ND	440.00	ND	ND	ND	ND
ESMP-13D	2/28/95	ND	ND	BLQ	ND	ND	ND	ND	BLQ	ND	ND	ND	ND	ND	ND	ND
ESMP-13D(D)	2/28/95	NA	NA	NA	NA	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND
ESMP-14S	2/28/95	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ESMP-14S(D)	2/28/95	NA	NA	NA	NA	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND
ESMP-14D	2/28/95	ND	BLQ	ND	ND	ND	ND	ND	BLQ	1.00	ND	ND	2.20	ND	ND	ND
ESMP-14D(D)	2/28/95	NA	NA	NA	NA	NA	NA	NA	NA	1.00	ND	ND	2.10	ND	ND	ND
ESMP-14DD	2/28/95	ND	BLQ	ND	ND	ND	ND	ND	BLQ	ND	ND	ND	ND	ND	BLC	ND
ESMP-14D	8/1/95	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ESMP-14D	12/1/95	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	4.2 J	ND	ND	ND	ND
ESMP-14D	3/1/96	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	5.80	ND	ND	ND	ND
ESMP-15S	2/28/95	BLQ	1.08	BLQ	BLQ	BLQ	BLQ	BLQ	1.08	ND	ND	ND	ND	ND	ND	ND
ESMP-15D	2/28/95	ND	BLQ	ND	ND	BLQ	ND	BLQ	BLQ	ND	ND	ND	ND	ND	ND	ND
ESMP-16S	3/1/95	89.18	BLQ	228.5	44.2	18.02	91.43	153.65	471.33	ND	ND	ND	BCL	ND	ND	ND
ESMP-16S	8/1/95	23.00	ND	23.00	ND	ND	ND	7.00	53.00	ND	ND	ND	ND	ND	ND	ND
ESMP-16S	12/1/95	38.00	ND	13.00	ND	ND	ND	15.00	66.00	ND	ND	ND	ND	ND	ND	ND
ESMP-16S	3/1/96	18.00	ND	ND	ND	ND	ND	ND	18.00	ND	ND	ND	ND	ND	ND	ND
ESMP-16D	3/1/95	6.46	BLQ	26.87	22.6	7.8	31.63	62.03	95.36	ND	ND	ND	BCL	ND	ND	ND
ESMP-16D	8/1/95	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ESMP-16D	12/1/95	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ESMP-16D	3/1/96	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ESMP-17S	2/28/95	ND	ND	ND	ND	ND	ND	ND	ND	1570.00	ND	152.00	4913.00	ND	BCL	ND
ESMP-17S	8/1/95	ND	ND	ND	ND	ND	ND	ND	ND	930.00	ND	7730.00	ND	ND	BCL	ND
ESMP-17S	12/1/95	ND	ND	ND	ND	ND	ND	ND	ND	690.00	ND	2900.00	ND	ND	BCL	ND
ESMP-17S	3/1/96	ND	ND	ND	ND	ND	ND	ND	ND	1200.00	ND	4500.00	ND	ND	[illegible]	ND
MW-2	3/1/95	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	ND	ND	ND	ND	ND	ND	ND
MW-3	2/28/95	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	ND	ND	ND	BLC	ND	1	ND
MW-3	8/1/95	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-3	12/1/95	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-3	3/1/96	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-4	3/1/95	BLQ	BLQ	BLQ	BLQ	BLQ	ND	BLQ	BLQ	ND	ND	ND	ND	ND	ND	ND
MW-4	8/1/95	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-4	12/1/95	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-4	3/1/96	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-5	3/1/95	17.19	41.94	317.97	229.22	91.23	55.48	375.93	753.03	ND	ND	ND	ND	ND	ND	ND
MW-5	8/1/95	ND	15.00	170.00	ND	ND	ND	210.00	395.00	ND	ND	ND	ND	ND	ND	ND

TABLE 4.5
BTEX AND CHLORINATED VOCs DETECTED IN GROUNDWATER
FEBRUARY-MARCH, 1995
HAZARDOUS WASTE STORAGE AREA
AMENDED CLOSURE/POST-CLOSURE PLAN
RICKENBACKER ANGB, OHIO

Sample Location	Sample Date	Benzene (μg/L)	Toluene (μg/L)	Ethylbenzene (μg/L)	p-Xylene (μg/L)	m-Xylene (μg/L)	o-Xylene (μg/L)	Total Xylenes (μg/L)	Total BTEX (μg/L)	Vinyl Chloride (μg/L)	1,1-DCE (μg/L)	T-1,2-DCE (μg/L)	C-1,2-DCE (μg/L)	1,2-DCA (μg/L)	TCE (μg/L)	PCE (μg/L)
MW-5	12/1/95	ND	12 J	140.00	ND	ND	ND	190.00	342.00	ND	ND	ND	ND	ND	ND	ND
MW-5	3/1/96	ND	4.8 J	54.00	ND	ND	ND	100.00	59.00	ND	ND	ND	ND	ND	ND	ND
MW-6	2/28/95	1.67	BLQ	BLQ	BLQ	BLQ	ND	BLQ	1.67	23.1	6.5	47.3	873	ND	ACL[e]	ND
MW-6	8/1/95	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	770.00	ND
MW-6	12/1/95	ND	ND	ND	ND	ND	ND	ND	ND	28.00	ND	ND	ND	ND	ND	ND
MW-6	3/1/96	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-6(D)	2/28/95	NA	NA	NA	NA	NA	NA	NA	NA	21.9	6.5	43.2	794	ND	9580	ND
MW-8	2/28/95	BLQ	ND	ND	ND	ND	ND	ND	BLQ	ND	ND	ND	ND	ND	BCL	ND
MW-8	8/1/95	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-8	12/1/95	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-8	3/1/96	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-9	3/1/95	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-10	3/1/95	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-11	2/28/95	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-11	8/1/95	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-11	12/1/95	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-11	3/1/96	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-11(D)	2/28/95	NA	NA	NA	NA	NA	NA	NA	NA	ND	ND	ND	ND	ND	BCL	ND
MW-12	2/28/95	ND	BLQ	ND	ND	ND	ND	ND	BLQ	ND	ND	ND	ND	ND	ND	ND
MW-12	8/1/95	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-12	12/1/95	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-12	3/1/96	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-12(D)	2/28/95	NA	NA	NA	NA	NA	NA	NA	NA	ND	ND	ND	ND	ND	BCL	ND

[a] ND= Not detected
[b] BLQ Below limit of quantitation
[c] NA= Not analyzed
[d] BCL= Below calibration limit (1.0 μg/L)
[e] ACL= Above calibration limit (5000 μg/L)

BTEX was not measured above detection limits. The ESMP-13 cluster is located adjacent to the 4 former 25,000-gallon USTs in the direction of groundwater flow. The next highest total BTEX concentrations were observed in the sample collected from MW-5, where free product has been removed in the past and where the free product thickness in February 1995 was measured as 0.35 foot. The total BTEX concentration in this sample in February/March 1995 was 753.03 µg/L, with a benzene concentration of 17.19 µg/L. A sample of the product also was collected from MW-5, and analysis yielded a total BTEX concentration of 627 µg/L with a nondetectable quantity of benzene, indicating a severely weathered product. The ESMP-16 cluster is located approximately 50 feet downgradient from MW-5. The total BTEX concentration at ESMP-16S in February/March 1995 was 471.33 µg/L, with a benzene concentration of 89.18 µg/L. In the sample collected from ESMP-16D, the total BTEX concentration was 95.36 µg/L, with a benzene concentration of 6.46 µg/L.

In August 1995, the maximum concentration of total BTEX was 430 µg/L in ESMP-13S. This is a decrease of about 55 percent from the concentration observed in February/March 1995. In December 1995, the maximum concentration of total BTEX was 509 µg/L at the same sampling location. Although this represents an increase from August 1995 levels, this is still about 45 percent less than that measured in February/March 1995. In March 1996, the maximum total BTEX concentration was only 440 µg/L at ESMP-13S. Similar to the August 1995 data set, this represents a decrease of about 55 percent from the February/March 1995 levels (or at least relatively no change since August 1995).

Figure 4.5 illustrates that the dissolved BTEX plume does not appear to be expanding in areal extent over the last year. Because concentrations of total BTEX are generally decreasing throughout the plume without significant horizontal or lateral migration, field-scale data suggest that natural chemical attenuation processes, specifically biodegradation, are operating at this site.

Chlorinated VOCs were measured in groundwater roughly coincident with elevated BTEX concentrations during all of the 1995 and completed 1996 sampling events (Figure 4.6). The distribution of the chlorinated VOCs in the groundwater is believed to be the result of multiple release events while the HWSA was being used to store waste oils and fuels. Chlorinated VOCs were detected in samples collected from ESMP-2D, ESMP-3S, ESMP-3D, ESMP-4S, ESMP-4D, ESMP-6D, ESMP-10S, ESMP-12S, ESMP-13S, ESMP-14D, ESMP-17S, MW-3, and MW-6. Concentrations of TCE ranged from 1 µg/L (MW-3, ESMP-3S, ESMP-10S) to about 9,600 µg/L in the sample from MW-6 in February/March 1995. Concentrations of 1,1-dichloroethene (1,1-DCE) ranged from 1.3 µg/L (ESMP-13S) to 11.7 µg/L (ESMP-17S) in February/March 1995. Concentrations of trans-1,2-DCE range from 1 µg/L (ESMP-2D) to 300 µg/L (ESMP-13S) and concentrations of cis-1,2-DCE range from 1 µg/L (ESMP-2D) to 4,913 µg/L (ESMP-17S). Cis-1,2-DCE is known to be the transformation product of TCE biodegradation. 1,2-dichloroethane (1,2-DCA) was encountered at one location in February/March 1995 (ESMP-12S) at a concentration of

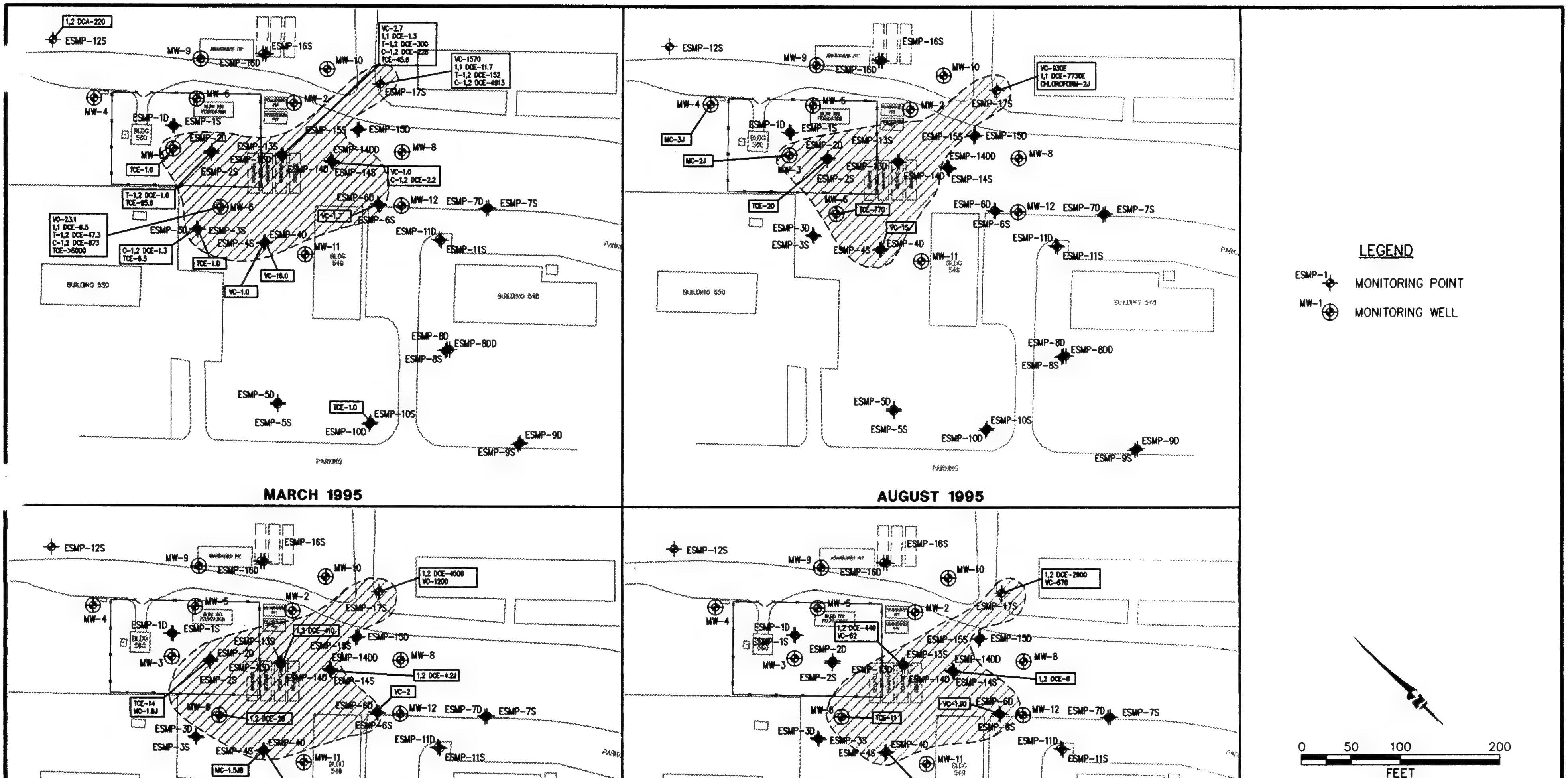


FIGURE 4.6

CHLORINATED VOCs IN GROUNDWATER

HWSA
Amended Closure/Post-Closure Plan
Rickenbacker ANGB, Ohio

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Denver, Colorado

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220 μg/L. Concentrations of vinyl chloride, a degradation product of DCE, range from 1 μg/L (ESMP-4S, ESMP-14S) to 1,570 μg/L (ESMP-17S) in February/March 1995.

In comparison, chlorinated VOC analytical data collected in August 1995 indicated a maximum TCE concentration of 9,580 μg/L at MW-6. This is almost identical to the maximum concentration of TCE detected at the sample location in February/March 1995. In December 1995, the maximum TCE concentration was only 180 μg/L, measured at MW-6. This represents a concentration reduction of about 99 percent from August 1995. In March 1996, the maximum concentration of TCE detected at the site (MW-6) was 770 μg/L. This represents an increase from the December 1995 levels, although a decrease of about 92 percent from earlier 1995 data.

Because DCE is a biotransformation product of TCE, it may be useful to track contaminant trends of this compound over time. In February/March 1995, the maximum concentration of cis-1,2-DCE was 5,065 μg/L (ESMP-17S). In August 1995, the maximum concentration of DCE increases to 7,730 μg/L (ESMP-17S). This represents an increase (or production) of about 34 percent. In December 1995, DCE concentrations were reduced to about 4,500 μg/L. In March 1996, DCE concentrations had been reduced to 2,900 μg/L (ESMP-17S). These reductions may be attributable to reductions in the parent compound TCE or subsequent transformations to vinyl chloride. This line of evidence will be further explored in Section 5.

The February/March 1995 maximum concentration of vinyl chloride, the least chlorinated of the VOCS detected at the site, was 1,570 μg/L (ESMP-17S). In August 1995, the maximum concentration of vinyl chloride, which was measured at the same sampling location, was 930 μg/L. In December 1995, the maximum concentration of vinyl chloride increased to 1,200 μg/L. The production of vinyl chloride could indicate that further dechlorination of TCE and DCE is occurring at the site. In March 1996, vinyl chloride decreased at ESMP-17S TO 690 μg/L. More recent data suggest that the concentration of vinyl chloride appears to be decreasing over time. This line of evidence will be revisited in Section 5.

Results of the analyses performed on samples collected during all of these more recent sampling events are summarized in Table 4.5. Laboratory reports are presented in Appendix E.

SECTION 5

PROPOSED CLOSURE APPROACH

This section describes the actions proposed to be implemented at the HWSA to facilitate closure of the unit. To implement closure of both contaminated soils and groundwater, the following activities have been completed or are proposed to be completed:

- Decontamination of Building 560 by cleaning the building and the drum wash pad (completed April 1996);
- Removal of the remaining four USTs (completed February 1995);
- Limited *in situ* remediation of organic soil contamination via passive or air injection bioventing;
- Natural oxidation of residual dissolved BTEX and natural reductive dehalogenation of residual dissolved chlorinated VOCs (in progress);
- *In situ* remediation of residual dissolved chlorinated VOCs via groundwater amendment (passive or active oxygenation), **if necessary**;
- Continued monitoring and site access controls as part of post-closure commitments; and
- Eventual exposure control by installation of taxiway (proposed as future land use).

Additional assessment activities will be completed to optimize the final design of the closure approach and to establish long-term performance standards/closure objectives for the site. Should these **proposed** actions prove insufficient to meet closure objectives, the AFBCA ~~has retained~~**will reconsider** installation of a cap and implementation of a groundwater extraction and treatment system as possible high-cost contingency actions.

5.1 SUMMARY OF DECONTAMINATION OF BUILDING 560

5.1.1 Building and Pad Decontamination Activities

Acids and spent desiccants were the most common types of waste stored in Building 560. The decontamination of Building 560 was completed as part of the IRP in April 1996~~5~~. Details of the decontamination activities, including analytical results from post-decontamination sampling, are presented in a recent technical report (AFCEE, 1996). The following briefly summarizes these activities.

The decontamination plans for the building included:

- Removing all items inside the building to facilitate decontamination activities;
- Vacuuming the building to remove dust, dirt, and debris;
- Washing the floor, walls, shelving of the building and the drum wash pad with a hot water pressure washer, scrub brushes, and an all-purpose household-type detergent; and
- Triple rinsing all surfaces with hot water.

Specific information on personnel safety and equipment decontamination procedures. that were followed as part of this activity is presented in Section 7 of this report.

All wash and rinse water generated during decontamination activities were collected using a wet/dry vacuum and transferred to a skid-mounted storage tank for testing and disposal. After rinsing with the hot water, rinseate samples to be tested analytically to determine the effectiveness of the decontamination activities were collected. These rinseate samples were collected by pouring high performance liquid chromatography (HPLC) water over the target media. The accumulated HPLC water was then collected for analysis. Until analytical results were received, the storage tank for the decontamination liquids was managed in compliance with all applicable hazardous waste tank requirements of the Ohio Administrative Code (OAC) 3745-66-90 through 3745-66-991.

5.1.2 Documenting Complete Decontamination

HPLC rinseate samples were submitted to a laboratory and analyzed using the methods listed in Table 5.1. Note that only representative analytes for each method with their respective reporting limits **(laboratory method detection limits [MDLs])** are provided. The building floor, walls, shelving, and drum wash pad were to be considered clean if the HPLC rinseate from the cleaning operation meets the following standards:

TABLE 5.1
HPLC RINSEATE ANALYTE LIST
HAZARDOUS WASTE STORAGE AREA
AMENDED CLOSURE/POST-CLOSURE PLAN
RICKENBACKER ANGB, OHIO

Compound	Reporting Limit (µg/L)
SW8240 - GC/MS Volatile Organics	
Acetone	0.8
Benzene	0.3
Chlorobenzene	0.1
Chloromethane	0.7
Chloroform	0.5
1,1-Dichloroethane	0.5
cis-Dichloroethene	0.2
trans-Dichloroethene	0.4
Dichloromethane	0.8
Ethylbenzene	0.3
Methyl ethyl ketone (2-butanone)	2
1,1,2,2-Tetrachloroethane	0.6
Tetrachloroethene	0.5
1,1,1-Trichloroethane	0.5
1,1,2-Trichloroethane	0.5
Trichloroethene	0.2
Toluene	0.6
Vinyl Chloride	0.6
m/p-Xylenes	0.4
o-Xylene	0.3
SW8270 - GC/MS Semivolatile Organics	
Acenaphthalene	10
Anthracene	10
m, p, and o-Dichlorobenzene	10
Flourene	10
Fluoranthene	10
Hexachlorobenzene	10
2-Methylnaphthalene	10
Naphthalene	10
Phenanthrene	10
Phenol	10
Pyrene	10
1,2,4-Trichlorobenzene	10
SW8010 - Organochlorine Pesticides and PCBs	
4,4'-DDE	0.02
4,4'-DDT	0.1
Dieldrin	0.02
Endrin	0.05
Heptachlor	0.02
PCB-1221	0.5
PCB-1232	0.5
Toxaphene	1
Cadmium	0.5
Chromium	1
Cobalt	20
Lead	2
Nickel	20

Source: Halliburton NUS, 1996

- The federal public drinking water maximum contaminant level (MCL) for as promulgated in 40 CFR 141.11 and OAC 3745-81-11 for inorganics and 40 CFR 141.12 and OAC 3745-81-12 for organics;

- If an MCL is not available for a particular contaminant, then fifteen times the federal maximum contaminant level goal (MCLG) as promulgated in 40 CFR 141.50 shall be used as the clean standard; or

- If the product of fifteen times the MCL or MCLG exceeds 1 mg/L or if neither an MCL nor an MCLG is available for a particular contaminant, 1 mg/L shall be used as the clean standard.

If the MCL or MCLG is less than the contaminant's analytical detection limit using methods found in the USEPA SW846 document (*Test Methods for Evaluation Solid Waste: Physical/Chemical Methods*), fifteen times the SW846 analytical detection limit shall be used as the clean standard.

Only a few of the analytes listed in Table 5.1 were detected in the HPLC rinseate samples at concentrations slightly above the laboratory MDL. No compounds **were**~~was~~ detected at concentrations in the rinseate water above the "clean" standards listed above. Consequently, the decontamination of Building 560 and the concrete pad are considered complete. Analytical results and supporting documentation are provided elsewhere. (AFCEE, 1996).

5.1.3 Wastewater Management

All wash and rinse water generated during the above-described decontamination procedures were pumped into a temporary holding tank. A representative sample of containerized water was collected and analyzed for volatiles, semi-volatiles, pesticides/PCBS, metals, and pH. Because none of the analytes exceeded the "clean" standards listed above, the containizered waste did not need to be managed as a listed hazardous waste. On May 13, 1996, the AFBCA requested the city of Columbus to approve a 300-gallon wastewater discharge to the Columbus sewer system. **After receiving approval from the City of Columbus on May 30, 1996, the AFBCA discharged the wastewater to the sanitary sewer located near Building 560 on June 4, 1996.**

5.2 UNDERGROUND STORAGE TANK REMOVAL

The four former USTs present adjacent to the site were removed on February 16 and 17, 1995 by Ogden Environmental and Energy Services, Inc. (Ogden, 1995). The following summary describes tasks performed during the tank removal process. All applicable guidelines of the Ohio Department of Commerce, Division of State Fire Marshal, Bureau of Underground Storage Tank Regulations were followed.

On February 16, 1995, the contents of the four 25,000-gallon USTs were inspected and sampled. Following sampling and prior to tank removal, the contents of the tanks were pumped out, transported offsite, and recycled. During the excavation process, a water line located near the western end of the USTs was damaged, resulting in flooding of the excavation. Two monitoring wells (MW-1 and MW-7) were also removed during the excavation process.

The water that had entered the USTs was treated onsite by Petro's mobile water treatment unit before it was discharged to the closest sanitary sewer inlet. The water pipe was disposed offsite on February 28, 1995 at the **Athens**~~Hathens~~-Hocking Reclamation Center. Soils surrounding the USTs were excavated and stockpiled to allow for tank removal. Excavated soils were visually examined and screened for VOC contamination using a photoionization detector (PID). Contaminated soil was segregated and placed in roll-off containers for analysis and proper disposal. Soil that was not contaminated (based on field screening) was placed on 6-mil polyethylene sheeting in the former HWSA and returned to the excavation following UST removal. Concrete encountered in the excavation was placed in roll-offs for analysis and disposal. Following removal from the excavation, the USTs were decontaminated and transported offsite for recycling.

Two soil samples and one water sample were collected from the excavation following the removal of the USTs. One soil sample also was collected from each of the three roll-offs in which the contaminated soil from the excavation was placed. After characterization of the soil, the contents of the roll-offs were disposed of in an appropriate manner (Ogden, 1995).

Following UST removal activities, the damaged water line was repaired, and the excavation was backfilled. Prior to backfilling, a layer of fine gravel was placed in the bottom of the excavation. Backfilling of the excavation was completed with the stockpiled soil from the excavation. The site was then compacted, graded, seeded, and covered with straw mulch.

Complete details of the UST removal activities and analytical results for all samples collected during UST removal are presented in the Closure Report prepared by Ogden Environmental and Energy Services, Inc. and submitted to the Air Force Base Conversion Agency on August 11, 1995.

5.3 REMEDIATION OF CONTAMINATED SOILS

Remediation of residual soil contamination in the source area by passive or **forced** air injection bioventing may be necessary to support a risk-based closure of the HWSA. Remediation of soil contamination would assure that no hypothetical onsite receptor could be exposed to unacceptable concentrations of contamination remaining in site soils. Remediation of soil contamination may also enhance the natural remediation of residual groundwater contamination at the site by removing a potential source of contaminant mass.

Bioventing is an innovative technology that uses either barometric pressure changes or low rates of air injection to supply oxygen to soil bacteria employed in the biodegradation of fuel hydrocarbons. A bioventing pilot test would need to be completed at the HWSA as part of closure activities to assess whether this low-cost source reduction technology could be used to remediate contaminated soil. **This test is planned as part of additional assessment activities to be completed in 1997.** Bioventing would only be effective on soil VOCs and SVOCs; elevated concentrations of metals would not be effectively remediated by this approach. However, remediation of fuel hydrocarbon contamination in source area soils may be sufficient to reduce the cumulative risks posed by residual contamination to acceptable levels. Futhermore, remediation of this fraction of soil contamination would likely enhance the remediation of groundwater. No metals were detected in groundwater samples (Section 4).

Based on the extent of shallow VOC contamination at the site, a single vent well and 3 vapor monitoring points would be sufficient to effect remediation of source area soils. Pilot testing would consist of respiration testing, an air permeability test, and an oxygen influence test in accordance with the procedures described in the AFCEE protocol documents (Hinchee *et al.*, 1992; Downey and Hall, 1994). A conceptual layout of either a passive or **forced** air injection bioventing system is presented in Figure 5.1.

5.4 INTRINSIC REMEDIATION OF RESIDUAL GROUNDWATER CONTAMINATION

Intrinsic remediation is an innovative remedial approach that relies on natural contaminant attenuation processes to reduce contaminant mass, concentration, mobility, persistence, and toxicity in groundwater. Mechanisms for natural attenuation of petroleum hydrocarbons such **as** BTEX include advection, dispersion, dilution from recharge, sorption, volatilization, and biodegradation. Similar natural attenuation processes can operate on chlorinated compounds, provided appropriate environmental conditions are present. ~~Ohio EPA may consider the use of intrinsic remediation as a component of the remedial process, if sufficient evidence that these processes are operative and progressing are provided (proposed rule 3745-300-15)~~. **These processes may play a significant role in minimizing the mass, concentration, mobility, persistence, and toxicity of contaminants over time. Provided these processes are sufficient to at least minimize downgradient migration and/or interrupt potential exposure pathways, intrinsic remediation may serve to complement other remedial strategies (e.g., exposure controls, soil remediation).**

Of these natural attenuation processes, biodegradation is the only mechanism working to transform contaminants into innocuous byproducts. Intrinsic bioremediation occurs when indigenous microorganisms work to bring about a reduction in the total mass of contamination in the subsurface without the addition of nutrients. Patterns and rates of intrinsic remediation can vary markedly from site to site depending on governing physical and chemical processes. AFCEE sponsored a quantitative

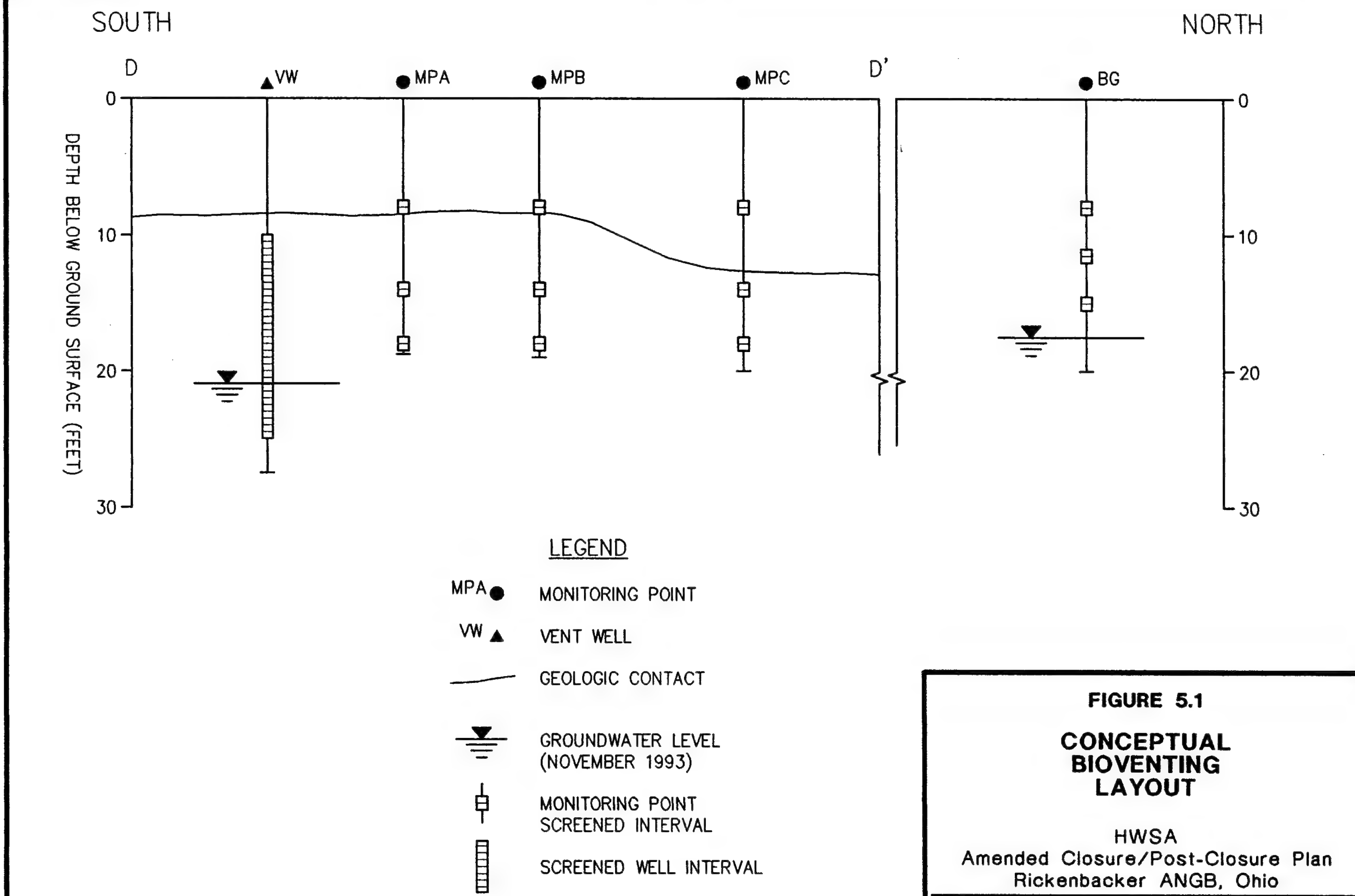

FIGURE 5.1

CONCEPTUAL BIOVENTING LAYOUT

HWSA
Amended Closure/Post-Closure Plan
Rickenbacker ANGB, Ohio

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

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assessment of the potential for natural chemical attenuation to reduce dissolved petroleum and chlorinated hydrocarbon concentrations in groundwater to acceptable levels. The objective of this particular section of the amended closure/post closure plan is to evaluate whether natural chemical attenuation processes are occurring at this site, and if so, whether these processes are progressing so that acceptable levels can be achieved within a reasonable timeframe.

5.4.1 Geochemical Indicators of BTEX Biodegradation

Microorganisms obtain energy for cell production and maintenance by facilitating thermodynamically advantageous redox reactions involving the transfer of electrons from electron donors to available electron acceptors. This results in the oxidation of the electron donor and the reduction of the electron acceptor. Electron donors at the site are natural organic carbon and fuel hydrocarbon compounds. Fuel hydrocarbons are completely degraded or detoxified if they are utilized as the primary electron donor for microbial metabolism (Bouwer, 1992). Electron acceptors are elements or compounds that occur in relatively oxidized states, and include oxygen, nitrate, ferric iron, sulfate, and carbon dioxide.

The driving force of BTEX degradation is electron transfer and is quantified by the Gibbs free energy of the reaction ($\Delta G°r$) (Stumm and Morgan, 1981; Bouwer, 1994; Godsey, 1994). The value of $\Delta G°r$ represents the quantity of free energy consumed or yielded to the system during the reaction. Although thermodynamically favorable, most of the reactions involved in BTEX oxidation cannot proceed abiotically because of the lack of activation energy. Microorganisms are capable of providing the necessary activation energy; however, they will facilitate only those redox reactions that have a net yield of energy (i.e. $\Delta G°r < 0$). Microorganisms preferentially utilize electron acceptors while metabolizing fuel hydrocarbons (Bouwer, 1992). DO is utilized first as the prime electron acceptor. After the DO is consumed, anaerobic microorganisms use electron acceptors in the following order of preference: nitrate, ferric iron hydroxide, sulfate, and finally carbon dioxide.

Depending on the types and concentrations of electron acceptors present (e.g., nitrate, sulfate, carbon dioxide), pH conditions, and redox potential, anaerobic biodegradation can occur by denitrification, ferric iron reduction, sulfate reduction, or methanogenesis. Other, less common anaerobic degradation mechanisms such as manganese or nitrate reduction may dominate if the physical and chemical conditions in the subsurface favor use of these electron acceptors. Anaerobic destruction of the BTEX compounds is associated with the accumulation of fatty acids, production of methane, solubilization of iron, and reduction of nitrate and sulfate (Cozzarelli *et al.*, 1990; Wilson *et al.*, 1990). Environmental conditions and microbial competition ultimately determine which processes will dominate. Vroblesky and Chapelle (1994) show that the dominant terminal electron accepting process can vary both temporally and spatially in an aquifer with fuel hydrocarbon contamination.

Site groundwater data for electron acceptors such as nitrate and sulfate suggest that intrinsic remediation of hydrocarbons in the shallow aquifer by denitrification and sulfate reduction is occurring. In addition, data for ferrous iron (Fe^{2+}) and methane suggest that anaerobic degradation is proceeding via ferric iron reduction and methanogenesis. Because both site and background concentrations of DO are low, aerobic degradation is not believed to contribute significantly to the attenuation of BTEX in site groundwater. Geochemical parameters for site groundwater are discussed in the following sections.

5.4.1.1 Dissolved Oxygen

Dissolved oxygen (DO) concentrations were measured at monitoring wells and monitoring points at the time of groundwater sampling during the 1995 and 1996 sampling events. The results are summarized in Table 5.2 and presented in Figure 5.2. DO is generally found in low concentrations throughout the source area, suggesting that anaerobic processes are favored. A DO concentration greater than 1 mg/L is considered necessary to support aerobic processes. DO concentrations greater than 1 mg/L were measured at several locations, none of which are in the immediate proximity of the BTEX plume (Figure 5.2). DO is an important, initial electron acceptor at this site until residual contamination effectively reduce do concentrations.

The stoichiometry of BTEX mineralization to carbon dioxide and water caused by aerobic microbial biodegradation is presented in Table 5.3. The average mass ratio of oxygen to total BTEX is approximately 3.14 to 1. This translates to the mineralization of approximately 0.32 mg of BTEX for every 1.0 mg of DO consumed. Considering MW-11, with a February/March 1995 DO concentration of 3.9 mg/L, as representative of background DO concentrations in the vicinity, the shallow groundwater at this site has the capacity to assimilate 1.25 mg/L (1250 μg/L) of total BTEX through aerobic biodegradation. This estimate of the assimilative capacity of DO is potentially conservative because subsequent sampling events indicate that background concentrations of DO may be higher than measured in February/March 1995.

5.4.1.2 Nitrate/Nitrite

Concentrations of nitrate/nitrite [as nitrogen (N)] were measured in groundwater samples collected in 1995 and 1996. The results are presented in Figure 5.3. Reduced nitrate/nitrite (as N) concentrations less than or equal to 0.1 mg/L were measured in an area encompassing the area of highest total BTEX concentrations (Figure 5.3) The highest measured nitrate/nitrite concentration of 9.1 mg/L was measured in February/March 1995 in monitoring well MW-11. The samples with the highest nitrate/nitrite concentrations are relatively removed from the area of highest BTEX concentration and are thought to represent the background nitrate concentrations for BTEX biodegradation at the site.

TABLE 5.2
GROUNDWATER GEOCHEMICAL DATA
HAZARDOUS WASTE STORAGE AREA
AMENDED CLOSURE/POST-CLOSURE PLAN
RICKENBACKER ANGB, OHIO

Sample Number	Sample Date	Water Temp. (°C)	pH	Conductivity (μmhos/cm)	Dissolved Oxygen (mg/L)	Redox Potential (mV)	Total Alkalinity (mg/L)	Hydrogen Sulfide (mg/L)	Ferrous Iron (mg/L)	Chloride (mg/L)	Sulfate (mg/L)	NO_2+NO_3 Nitrogen (mg/L)	TOC (mg/L)	Methane (mg/L)	Ethene (mg/L)	CO_2 (mg/L)	NH_3 (mg/L)
ESMP-1D	2/28/95	11.4	7.22	703	0.6	190.0	336	NA[a]	0.1	10.2	41.4	<0.05	3.3	0.058	ND[b]	170	0.22
ESMP-2D	2/28/95	12.4	7.16	761	0.0	-63.3	344	NA	1.3	13.1	56.7	0.09	2.6	0.067	ND	190	0.1
ESMP-2D	8/1/95	17.1	6.76	740	0.6	-59.0	350	0.007	1.5	9.2	44.5	0.03		0.074	ND		ND
ESMP-2D	12/1/95	11.7	7.25	731	NA	-63.0	350	0.003	NT	7.8	47	0.1		0.075	ND		0.25
ESMP-2D	3/1/96	10.3	7.35	543	6.1	NA		0.001	1.6					0.132	ND		0.1
ESMP-3S	2/28/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
ESMP-3D	2/28/95	12.4	7.06	810	0.0	-16.7	389	NA	1.0	10.9	52.8	0.05	1.6	0.067	ND	216	0.11
ESMP-3D	8/1/95	16..4	6.78	798	1.3	-51.0	381	0.006	1.3	9.2	50	0.04		0.063	ND		ND
ESMP-3D	12/1/95	12..2	8.31	808	2.7	-31.0	390	0.024	1.1	7.2	50	ND		0.039	ND		0.2
ESMP-3D	3/1/96	11.8	7.29	582	4.9	NA		0.002	1.0					0.049	ND		ND
ESMP-4S	2/28/95	NA	6.98	965	NA	23.1	378	NA	0.8	5.1	144	0.08	2.7	0.109	ND	186	0.1
ESMP-4S	8/1/95	23.6	6.58	NA	0.8	83.0	486	0.648	NA	6.1	227	0.03		0.414	ND		ND
ESMP-4S	12/1/95	12.2	8.69	1235	2.3	127.0	650	0.390D	0.5	8.3	290	ND		0.344	ND		0.15
ESMP-4S	3/1/96	8.4	7.25	612	4.3	NA		.389D	.29D					ND	ND		ND
ESMP-4D	2/28/95	10.2	7.02	874	0.7	140.0	394	NA	0.1	7.31	87.1	0.08	2.6	0.015	0.001	220	0.06
ESMP-4D	8/1/95	17.5	6.66	905	1.4	57.0	400	0.113	0.7	6.00	96.3	0.04		0.039	0.004		ND
ESMP-4D	12/1/95	12.2	8.62	936	1.9	52.0	400	0.039	0.3	4.50	120	ND		0.164	ND		ND
ESMP-4D	3/1/96	9.7	7.20	636	4.2	NA		0.017	0.3					0.139	ND		ND
ESMP-5S	2/27/95	12.1	7.30	730	0.8	200.0	293	NA	<0.05	4.91	55.8	7.94	1.7	0.002	ND	150	<.05
ESMP-5D	2/27/95	13.9	7.07	751	0.3	-45.8	370	<0.1	1.9	9.04	38.5	0.07	2.0	0.106	ND	228	0.17
ESMP-6D	2/28/95	13.5	7.18	840	0.1	-24.4	385	<0.1	0.9	10.3	61.5	0.09	4.1	0.079	ND	168	5.92
ESMP-6D	8/1/95	19.8	6.70	839	1.3	-31.0	379	0.006	1.3	10.0	55.8	0.1		0.08	ND		ND
ESMP-6D	12/1/95	13.6	7.02	810	NA	-11.0	380	NA	1.4	8.3	53	ND		0.08	ND		ND
ESMP-6D	3/1/96	13	7.31	609	4.8	NA		0.007	1.5					0.082	ND		ND
ESMP-7S	2/28/95	8.2	7.33	632	0.2	199.0	296	NA	0.1	8.24	32.7	1.78	4.4	0.017	ND	124	0.49
ESMP-7D	2/28/95	12.5	7.29	703	0.4	-53.5	212	<0.1	1.6	18.8	54.5	0.09	5.0	0.478	ND	208	0.12
ESMP-8S	2/27/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.23	5.1	0.003	ND	NA	0.07
ESMP-8S	8/1/95	25.3	7.5	578.0	6.7	156.0	331.0	0.3	0.4	3.7	27.8	0.21		ND	ND		ND
ESMP-8S	12/1/95	10.3	8.6	601.0	3.5	125.0	280.0	0.2	0.4	1.5	29	ND		ND	ND		0.29
ESMP-8S	3/1/96	7	7.8	375.0	9.5	NA		0.6	0.3					ND	ND		0.1
ESMP-8D	2/27/95	NA	7.10	779	NA	-93.8	380	<0.1	3.1	NA	NA	NA	NA	NA	NA	100	NA
ESMP-8D(D)[c]	2/27/95	NA	7.08	781	NA	-89.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
ESMP-8DD	2/27/95	14.4	NA	NA	0.5	NA	NA	NA	NA	7.26	54.5	0.07	1.3	0.006	ND	NA	0.19
ESMP-8DD(D)	2/27/95	NA	NA	NA	NA	NA	NA	NA	NA	7.33	55	NA	1.3	NA	NA	NA	NA
ESMP-9S	2/28/95	NA	7.13	799	NA	115.0	254	NA	0.1	7.2	48.1	5.75	7.2	0.015	ND	188	0.34
ESMP-9S(D)	2/28/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5.95	4.8	0.016	ND	NA	0.32
ESMP-9D	2/28/95	12.8	7.11	803	0.0	2.7	393	<0.1	0.8	6.3	65	0.08	1.6	0.008	ND	150	<.05
ESMP-9D(D)	2/28/95	NA	7.10	817	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
ESMP-10S	2/27/95	NA	7.22	667	NA	152.0	314	NA	0.3	5.05	44.2	2.75	2.9	0.003	ND	192	0.05
ESMP-10S	8/1/95	22.7	7.31	687	6.4	159.0	301	0.421	NA	2.90	42.7	0.93		ND	ND		0.37
ESMP-10S	12/1/95	11	8.53	660	3.1	65.0	340	0.164	0.3	2.30	40	1.6		ND	ND		0.23
ESMP-10S	3/1/96	9.3	7.58	439	6.7	NA		0.6	0.3					ND	ND		0.1

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TABLE 5.2
GROUNDWATER GEOCHEMICAL DATA
HAZARDOUS WASTE STORAGE AREA
AMENDED CLOSURE/POST-CLOSURE PLAN
RICKENBACKER ANGB, OHIO

Sample Number	Sample Date	Water Temp. (°C)	pH	Conductivity (µmhos/cm)	Dissolved Oxygen (mg/L)	Redox Potential (mV)	Total Alkalinity (mg/L)	Hydrogen Sulfide (mg/L)	Ferrous Iron (mg/L)	Chloride (mg/L)	Sulfate (mg/L)	NO_2+NO_3 Nitrogen (mg/L)	TOC (mg/L)	Methane (mg/L)	Ethene (mg/L)	CO_2 (mg/L)	NH_3 (mg/L)
ESMP-10D	2/27/95	NA	7.01	823	0.1	-30.0	426	<0.1	1.8	8.21	36.1	0.11	3.9	0.012	ND	296	0.06
ESMP-11D	2/27/95	14	7.09	786	1.1	-70.1	376	<0.1	2.5	5.11	57.8	0.08	2.6	0.105	ND	220	0.07
ESMP-11D(D)	2/27/95	NA	NA	NA	NA	NA	NA	NA	NA	5.0	58.9	NA	2.6	NA	NA	NA	NA
ESMP-13S	2/28/95	8.1	7.21	841	0.3	-136.0	386	0.1	3.2	23.5	38.3	0.09	27.6	7.83	0.001	330	0.43
ESMP-13S	8/1/95	17.2	6.96	NA	0.4	-125.0	374	0.011	2.7	16.0	6.09	0.04		19.163	0.002		0.039
ESMP-13S	12/1/95	12.5	7.36	762	NA	-90.0	390	0.003	2.5	17.0	1.8	ND		15.36	ND		0.22
ESMP-13S	3/1/96	11	7.46	555	5.6	NA		0.03	1.88D					ND	0.005		0.5
ESMP-13S(D)	2/28/95	NA	NA	NA	NA	NA	NA	NA	NA	23.3	38.2	NA	NA	NA	NA	NA	NA
ESMP-13D	2/28/95	11.1	7.14	775	0.5	-136.0	364	0.1	1.5	17.0	54.9	0.09	2.1	0.11	ND	170	0.07
ESMP-13D(D)	2/28/95	NA	NA	NA	NA	NA	NA	NA	NA	17.8	57.9	0.09	2.1	0.114	ND	NA	0.07
ESMP-14S	2/28/95	11.6	7.28	760	0.2	-115.0	440	<0.1	3.2	7.29	19.2	0.09	3.1	0.462	ND	288	0.13
ESMP-14S(D)	2/28/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.09	3.1	NA	NA	NA	0.12
ESMP-14D	2/28/95	12.1	7.09	767	0.2	-116.0	393	<0.1	1.4	17.0	58.7	0.11	3.2	0.106	ND	214	0.09
ESMP-14D	8/1/95	16.1	6.73	46	0.7	-89.0	350	0.044	1.6	15.3	48.6	0.05		0.138	ND		ND
ESMP-14D	12/1/95	11.5	7.43	759	NA	-41.0	360	0.015	1.3	9.1	51	ND		0.117	ND		ND
ESMP-14D	3/1/96	10.7	7.42	531	6.3	NA		0.005	1.4					0.119	ND		ND
ESMP-14D(D)	2/28/95	NA	NA	NA	NA	NA	NA	NA	NA	16.3	57.1	0.11	3.6	NA	NA	NA	0.08
ESMP-15S	2/28/95	11.8	7.55	731	0.2	-95.0	185	<0.1	1.1	16.1	206	0.32	97.0	0.136	ND	136	0.19
ESMP-15S(D)	2/28/95	NA	NA	NA	NA	NA	NA	NA	NA	15.6	206	NA	NA	0.129	ND	NA	NA
ESMP-15D	2/28/95	9.3	8.22	764	1.2	72.1	103	NA	0.6	20.1	264	0.41	114.2	0.007	ND	90	0.1
ESMP-16S	3/1/95	11.9	7.00	2150	0.0	-143.0	522	<0.1	14.8	53.3	208	<0.05	523.0	3.067	ND	510	1.22
ESMP-16S	8/1/95	19.1	6.82	NA	0.4	-134.0	430	0.012	2.94D	21.2	939	0.05		5.344	ND		0.65
ESMP-16S	12/1/95	12.5	7.15	1978	NA	-111.0	560	0.024	2.05D	19.0	610	ND		9.278	ND		0.053
ESMP-16S	3/1/96	9	7.38	1435	6.1	NA		0.146	2.41D					4.7	ND		0.6
ESMP-16D	3/1/95	13.8	6.94	2070	0.0	-170.0	443	0.5	5.7	19.5	938	<0.05	61.3	1.15	ND	422	0.75
ESMP-16D	8/1/95	19	6.74	44	0.8	-126.0	424	0.028	2.34D	NA	NA	NA		0.357	ND		ND
ESMP-16D	12/1/95	12	7.11	1144	NA	-75.0	380	0.012	2.0	12.0	240	ND		0.341	ND		0.48
ESMP-16D	3/1/96	10.5	7.41	820	6.8	NA		0.008	2.4					0.251	ND		0.4
ESMP-16D(D)	3/1/95	NA	6.95	2080	NA	-172.0	NA	NA	NA	20.7	895	<0.05	NA	1.182	ND	NA	0.74
ESMP-17S	2/28/95	11.3	7.24	773	0.2	-125.0	380	<0.1	4.5	7.26	41	0.09	2.0	2.296	0.057	190	0.29
ESMP-17S	8/1/95	17.9	6.97	NA	0.5	-113.0	368	0.017	2.7	5.60	38.3	0.04		2.73	0.057		ND
ESMP-17S	12/1/95	12.5	7.48	751	NA	-99.0	360	NA	2.2	3.60	48	ND		1.775	0.056		0.13
ESMP-17S	3/1/96	10.2	7.57	518	5.3	NA		0.004	3.3					2.576	0.004		0.1
MW-2	3/1/95	10.8	7.16	832	0.5	212.0	389	NA	<0.05	7.79	61.2	0.09	5.3	0.661	ND	256	0.05
MW-3	2/28/95	10.1	7.08	943	1.8	212.0	368	NA	<0.05	21.1	127	0.1	4.6	0.003	ND	276	0.06
MW-3	8/1/95	17	6.70	776	1.8	157.0	387	0.078	0.4	16.0	72	0.05		ND	ND		ND
MW-3	12/1/95	11.2	7.18	922	NA	82.0	420	0.013	0.0	12.0	87	1.2		ND	ND		0.2
MW-3	3/1/96	8.8	7.38	631	13.4	NA		0.032	0.1					ND	ND		0.1
MW-3(D)	2/28/95	NA	7.10	961	NA	213.0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-4	3/1/95	10.7	6.95	859	1.5	210.0	402	NA	<0.05	19.0	103	0.15	7.2	0.002	ND	316	0.09
MW-4	8/1/95	18.4	6.52	800	2.0	231.0	446	0.051	0.1	2.2	89	0.05		ND	ND		ND
MW-4	12/1/95	10.1	7.06	863	NA	217.0	390	0.003	0.0	1.7	84	0.1		ND	ND		0.11

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TABLE 5.2
GROUNDWATER GEOCHEMICAL DATA
HAZARDOUS WASTE STORAGE AREA
AMENDED CLOSURE/POST-CLOSURE PLAN
RICKENBACKER ANGB, OHIO

Sample Number	Sample Date	Water Temp. (°C)	pH	Conductivity (μmhos/cm)	Dissolved Oxygen (mg/L)	Redox Potential (mV)	Total Alkalinity (mg/L)	Hydrogen Sulfide (mg/L)	Ferrous Iron (mg/L)	Chloride (mg/L)	Sulfate (mg/L)	NO_2+NO_3 Nitrogen (mg/L)	TOC (mg/L)	Methane (mg/L)	Ethene (mg/L)	CO_2 (mg/L)	NH_3 (mg/L)
MW-4	3/1/96	7.4	7.35	446	12.8	NA		0.001	0.0					ND	ND		0.01
MW-4(D)	3/1/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.15	NA	NA	NA	NA	0.09
MW-5	3/1/95	NA	7.07	942	NA	-115.0	416	NA	16.5	8.0	6.57	0.08	139.6	7.693	ND	478	0.45
MW-5	8/1/95	NA	NA	NA	NA	NA	391	0.365	2.6	3.8	19.4	0.11		0.33	ND		0.11
MW-5	12/1/95	NA	NA	NA	NA	NA	470	0.019D	2.08D	8.3	22	0.1		2.493	ND		1.4
MW-5	3/1/96							.041D	.56D					0.186	ND		0.3
MW-5(D)	3/1/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.178	ND	NA	NA
MW-6	2/28/95	10.5	6.96	1017	0.4	181.0	387	NA	<0.05	NA	NA	NA	5.5	0.013	ND	226	NA
MW-6	8/1/95	17.5	6.57	833	1.1	41.0	409	0.27	0.4	9.4	129.0	0.2		ND	ND		ND
MW-6	12/1/95	11.1	8.44	919	4.1	151.0	340	0.09	0.2	9.5	140.0	1.3		ND	ND		0.2
MW-6	3/1/96	7.6	7.38	456	9.6	NA		0.019	0.0					ND	ND		ND
MW-6(D)	2/28/95	NA	6.93	1057	NA	178.0	NA	NA	NA	NA	NA	NA	5.6	NA	NA	NA	NA
MW-8	2/28/95	10.3	7.34	719	4.1	209.0	391	NA	<0.05	8.0	20	0.06	13.4	0.015	ND	208	0.1
MW-8	8/1/95	18.8	6.69	753	4.3	233.0	383	0.261	0.4	1.9	15.7	0.04		ND	ND		ND
MW-8	12/1/95	10.6	7.44	746	NA	57.0	410	0.056	0.1	1.5	15	0.17		ND	ND		ND
MW-8	3/1/96	7.5	7.42	483	6.8	NA		0.067	0.1					0.081	ND		0.1
MW-9	3/1/95	8.9	6.82	1596	0.2	19.1	480	NA	2.4	18.9	496	0.08	7.6	0.004	ND	412	0.27
MW-9(D)	3/1/95	NA	NA	NA	NA	NA	NA	NA	NA	20.0	498	NA	7.6	NA	NA	NA	NA
MW-10	3/1/95	13.2	7.11	1172	0.0	-92.1	390	<0.1	2.2	23.4	296	0.07	5.7	0.04	ND	258	0.49
MW-11	2/28/95	11.4	7.38	566	3.9	194.0	211	NA	<0.05	5.65	44.8	9.1	1.0	BLQ[d]	ND	94	<.05
MW-11	8/1/95	18.2	7.01	560	4.7	178.0	275	0.118	0.2	2.70	49.7	1.7		ND	ND		ND
MW-11	12/1/95	12.4	8.40	554	5.8	241.0	240	0.003	0.0	2.40	41	2.9		ND	ND		0.12
MW-11	3/1/96	9.4	7.28	594	5.2	NA		0.002	0.0					ND	ND		ND
MW-12	2/28/95	12.4	7.04	854	0.6	38.6	347	NA	0.3	19.8	187	0.57	3.5	0.001	ND	300	<.05
MW-12	8/1/95	17.4	6.81	834	1.0	143	480	0.091	1.1	NA	NA	NA		ND	ND		ND
MW-12	12/1/95	14.1	6.93	899	NA	142	380	0.005	0.17	9.2	86	0.44		ND	ND		ND
MW-12	3/1/96	9.6	7.38	625	6.2	NA		0.002	0.11					ND	ND		ND
MW-12(D)	2/28/95	NA	NA	NA	NA	NA	NA	NA	NA	13.3	91.7	NA	3.6	NA	NA	NA	NA

[a] NA = not available.
[b] ND = not detected.
[c] (D) = duplicate sample.
[d] BLQ = below lower limit of quantitation (0.001 μg/L).

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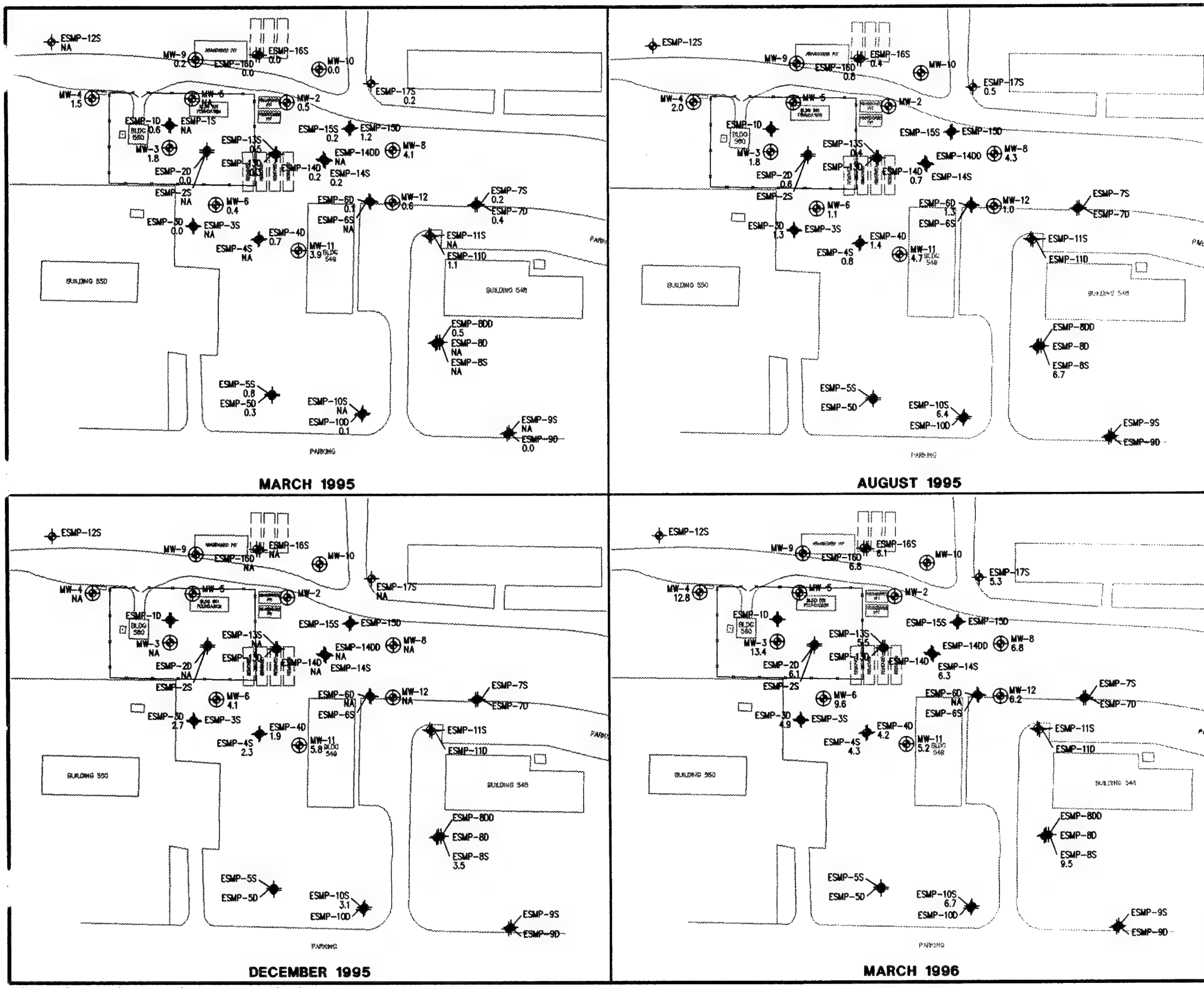

LEGEND

ESMP-1 1.3 MONITORING POINT WITH DISSOLVED OXYGEN CONCENTRATION(mg/L)

MW-1 4.7 MONITORING WELL WITH DISSOLVED OXYGEN CONCENTRATION(mg/L)

NA NOT AVAILABLE

0 50 100 200
FEET

FIGURE 5.2

DISSOLVED OXYGEN CONCENTRATIONS IN GROUNDWATER

HWSA
Amended Closure/Post-Closure Plan
Rickenbacker ANGB, Ohio

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

TABLE 5.3
COUPLED OXIDATION REACTIONS

HAZARDOUS WASTE STORAGE AREA
AMENDED CLOSURE/POST-CLOSURE PLAN
RICKENBACKER ANGB, COLUMBUS OHIO

Coupled Benzene Oxidation Reactions	ΔG°_r (kcal/mole Benzene)	ΔG°_r (kJ/mole Benzene)	Stoichiometric Mass Ratio of Electron Acceptor to Compound
$7.5 O_2 + C_6H_6 \Rightarrow 6CO_{2,g} + 3H_2O$ *Benzene oxidation /aerobic respiration*	-765.34	-3202	3.07:1
$6NO_3^- + 6H^+ + C_6H_6 \Rightarrow 6CO_{2,g} + 6H_2O + 3N_{2,g}$ *Benzene oxidation / denitrification*	-775.75	-3245	4.77:1
$30H^+ + 15\underline{MnO_2} + C_6H_6 \Rightarrow 6CO_{2,g} + 15Mn^{2+} + 18H_2O$ *Benzene oxidation / manganese reduction*	-765.45	-3202	10.56:1
$3.75\ NO_3^- + C_6H_6 + 7.5\ H^+ + 0.75\ H_2O \Rightarrow 6\ CO_2 + 3.75\ NH_4^+$ *Benzene oxidation / nitrate reduction*	-524.1	-2193	2.98:1
$60H^+ + 30\underline{Fe(OH)_{3,a}} + C_6H_6 \Rightarrow 6CO_2 + 30Fe^{2+} + 78H_2O$ *Benzene oxidation / iron reduction*	-560.10	-2343	21.5:1
$7.5H^+ + 3.75SO_4^{2-} + C_6H_6 \Rightarrow 6CO_{2,g} + 3.75H_2S^o + 3H_2O$ *Benzene oxidation / sulfate reduction*	-122.93	-514.3	4.61:1
$4.5H_2O + C_6H_6 \Rightarrow 2.25CO_{2,g} + 3.75CH_4$ *Benzene oxidation / methanogenesis*	-32.40	-135.6	0.77:1
$15C_2Cl_4 + 12H_2O + C_6H_6 \Rightarrow 15C_2HCl_3 + 6CO_2 + 15H^+ + 15Cl^-$ *Benzene oxidation/ Tetrachloroethylene reductive dehalogenation*	-358.59	-1500	31.8:1
$15C_2HCl_3 + 12H_2O + C_6H_6 \Rightarrow 15C_2H_2Cl_2 + 6CO_2 + 15H^+ + 15Cl^-$ *Benzene oxidation/ Trichloroethylene reductive dehalogenation*	-350.04	-1465	25.2:1
$15C_2H_2Cl_2 + 12H_2O + C_6H_6 \Rightarrow 15C_2H_3Cl + 6CO_2 + 15H^+ + 15Cl^-$ *Benzene oxidation/ cis-Dichloroethylene reductive dehalogenation*	-278.64	-1166	18.6:1
$15C_2H_3Cl + 12H_2O + C_6H_6 \Rightarrow 15C_2H_4 + 6CO_2 + 15H^+ + 15Cl^-$ *Benzene oxidation/ Vinyl chloride reductive dehalogenation*	-327.37	-1370	11.9:1

Coupled Toluene Oxidation Reactions	ΔG°_r (kcal/mole Toluene)	ΔG°_r (kJ/mole Toluene)	Stoichiometric Mass Ratio of Electron Acceptor to Compound
$9O_2 + C_6H_5CH_3 \Rightarrow 7CO_{2,g} + 4H_2O$ *Toluene oxidation /aerobic respiration*	-913.76	-3823	3.13:1
$7.2NO_3^- + 7.2H^+ + C_6H_5CH_3 \Rightarrow 7CO_{2,g} + 7.6H_2O + 3.6N_{2,g}$ *Toluene oxidation / denitrification*	-926.31	-3875	4.85:1
$36H^+ + 18\underline{MnO_2} + C_6H_5CH_3 \Rightarrow 7CO_{2,g} + 18Mn^{2+} + 22H_2O$ *Toluene oxidation / manganese reduction*	-913.89	-3824	10.74:1
$72H^+ + 36\underline{Fe(OH)_{3,a}} + C_6H_5CH_3 \Rightarrow 7CO_2 + 36Fe^{2+} + 94H_2O$ *Toluene oxidation / iron reduction*	-667.21	-2792	21.86:1
$9H^+ + 4.5SO_4^{2-} + C_6H_5CH_3 \Rightarrow 7CO_{2,g} + 4.5H_2S^o + 4H_2O$ *Toluene oxidation / sulfate reduction*	-142.86	-597.7	4.7:1
$5H_2O + C_6H_5CH_3 \Rightarrow 2.5CO_{2,g} + 4.5CH_4$ *Toluene oxidation / methanogenesis*	-34.08	-142.6	0.78:1
$18C_2Cl_4 + 14H_2O + C_6H_5CH_3 \Rightarrow 18C_2HCl_3 + 7CO_2 + 18H^+ + 18Cl^-$ *Toluene oxidation/ Tetrachloroethylene reductive dehalogenation*	-425.66	-1781	32.4:1
$18C_2HCl_3 + 14H_2O + C_6H_5CH_3 \Rightarrow 18C_2H_2Cl_2 + 7CO_2 + 18H^+ + 18Cl^-$ *Toluene oxidation/ Trichloroethylene reductive dehalogenation*	-415.40	-1738	25.7:1
$18C_2H_2Cl_2 + 14H_2O + C_6H_5CH_3 \Rightarrow 18C_2H_3Cl + 7CO_2 + 18H^+ + 18Cl^-$ *Toluene oxidation/ cis-Dichloroethylene reductive dehalogenation*	-329.72	-1380	18.9:1
$18C_2H_3Cl + 14H_2O + C_6H_5CH_3 \Rightarrow 18C_2H_4 + 7CO_2 + 18H^+ + 18Cl^-$ *Toluene oxidation/ Vinyl chloride reductive dehalogenation*	-388.22	-1624	12.1:1

TABLE 5.3
COUPLED OXIDATION REACTIONS

HAZARDOUS WASTE STORAGE AREA
AMENDED CLOSURE/POST-CLOSURE PLAN
RICKENBACKER ANGB, COLUMBUS OHIO

Coupled Ethylbenzene Oxidation reactions	ΔG°_r kcal/mole Ethylbenzene	ΔG°_r kJ/mole Ethylbenzene	Stoichiometric Mass Ratio of Electron Acceptor to Compound
$10.5O_2 + C_6H_5C_2H_5 \Rightarrow 8CO_{2,g} + 5H_2O$ *Ethylbenzene oxidation /aerobic respiration*	-1066.13	-4461	3.17:1
$8.4NO_3^- + 8.4H^+ + C_6H_5C_2H_5 \Rightarrow 8CO_{2,g} + 9.2H_2O + 4.2N_{2,g}$ *Ethylbenzene oxidation / denitrification*	-1080.76	-4522	4.92:1
$46H^+ + 22MnO_2 + C_6H_5C_2H_5 \Rightarrow 8CO_{2,g} + 22Mn^{2+} + 28H_2O$ *Ethylbenzene oxidation / manganese reduction*	-1066.27	-4461	11.39:1
$84H^+ + 42Fe(OH)_{3,a} + C_6H_5C_2H_5 \Rightarrow 8CO_2 + 42Fe^{2+} + 110H_2O$ *Ethylbenzene oxidation / iron reduction*	-778.48	-3257	22.0:1
$10.5H^+ + 5.25SO_4^{2-} + C_6H_5C_2H_5 \Rightarrow 8CO_{2,g} + 5.25H_2S^o + 5H_2O$ *Ethylbenzene oxidation / sulfate reduction*	-166.75	-697.7	4.75:1
$5.5H_2O + C_6H_5C_2H_5 \Rightarrow 2.75CO_{2,g} + 5.25CH_4$ *Ethylbenzene oxidation / methanogenesis*	-39.83	-166.7	0.79:1
$21C_2Cl_4 + 16H_2O + C_6H_5C_2H_5 \Rightarrow 21C_2HCl_3 + 8CO_2 + 21H^+ + 21Cl^-$ *Ethylbenzene oxidation/ Tetrachloroethylene reductive dehalogenation*	-496.67	-2078	32.8:1
$21C_2HCl_3 + 16H_2O + C_6H_5C_2H_5 \Rightarrow 21C_2H_2Cl_2 + 8CO_2 + 21H^+ + 21Cl^-$ *Ethylbenzene oxidation/ Trichloroethylene reductive dehalogenation*	-484.70	-2028	26.0:1
$21C_2H_2Cl_2 + 16H_2O + C_6H_5C_2H_5 \Rightarrow 21C_2H_3Cl + 8CO_2 + 21H^+ + 21Cl^-$ *Ethylbenzene oxidation/ cis-Dichloroethylene reductive dehalogenation*	-384.74	-1610	19.2:1
$21C_2H_3Cl + 16H_2O + C_6H_5C_2H_5 \Rightarrow 21C_2H_4 + 8CO_2 + 21H^+ + 21Cl^-$ *Ethylbenzene oxidation/ Vinyl chloride reductive dehalogenation*	-452.99	-1895	12.3:1

Coupled m-Xylene Oxidation Reactions	ΔG°_r (kcal/mole *m*-xylene)	ΔG°_r (kJ/mole *m*-xylene)	Stoichiometric Mass Ratio of Electron Acceptor to Compound
$10.5O_2 + C_6H_4(CH_3)_2 \Rightarrow 8CO_{2,g} + 5H_2O$ *m-Xylene oxidation /aerobic respiration*	-1063.25	-4448	3.17:1
$8.4NO_3^- + 8.4H^+ + C_6H_4(CH_3)_2 \Rightarrow 8CO_{2,g} + 9.2H_2O + 4.2N_{2,g}$ *m-Xylene oxidation / denitrification*	-1077.81	-4509	4.92:1
$46H^+ + 22MnO_2 + C_6H_4(CH_3)_2 \Rightarrow 8CO_{2,g} + 22Mn^{2+} + 28H_2O$ *m-Xylene oxidation / manganese reduction*	-1063.39	-4449	11.39:1
$84H^+ + 42Fe(OH)_{3,a} + C_6H_4(CH_3)_2 \Rightarrow 8CO_2 + 42Fe^{2+} + 110H_2O$ *m-Xylene oxidation / iron reduction*	-775.61	-3245	22:1
$10.5H^+ + 5.25SO_4^{2-} + C_6H_4(CH_3)_2 \Rightarrow 8CO_{2,g} + 5.25H_2S^o + 5H_2O$ *m-Xylene oxidation / sulfate reduction*	-163.87	-685.6	4.75:1
$5.5H_2O + C_6H_4(CH_3)_2 \Rightarrow 2.75CO_{2,g} + 5.25CH_4$ *m-Xylene oxidation / methanogenesis*	-36.95	-154.6	0.79:1 [a]
$21C_2Cl_4 + 16H_2O + C_6H_4(CH_3)_2 \Rightarrow 21C_2HCl_3 + 8CO_2 + 21H^+ + 21Cl^-$ *m-Xylene oxidation/ Tetrachloroethylene reductive dehalogenation*	-493.79	-2066	32.8:1
$21C_2HCl_3 + 16H_2O + C_6H_4(CH_3)_2 \Rightarrow 21C_2H_2Cl_2 + 8CO_2 + 21H^+ + 21Cl^-$ *m-Xylene oxidation/ Trichloroethylene reductive dehalogenation*	-481.82	-2016	26.0:1
$21C_2H_2Cl_2 + 16H_2O + C_6H_4(CH_3)_2 \Rightarrow 21C_2H_3Cl + 8CO_2 + 21H^+ + 21Cl^-$ *m-Xylene oxidation/ cis-Dichloroethylene reductive dehalogenation*	-381.86	-1598	19.2:1
$21C_2H_3Cl + 16H_2O + C_6H_4(CH_3)_2 \Rightarrow 21C_2H_4 + 8CO_2 + 21H^+ + 21Cl^-$ *m-Xylene oxidation/ Vinyl chloride reductive dehalogenation*	-450.11	-1883	12.3:1

TABLE 5.3
COUPLED OXIDATION REACTIONS

HAZARDOUS WASTE STORAGE AREA
AMENDED CLOSURE/POST-CLOSURE PLAN
RICKENBACKER ANGB, COLUMBUS OHIO

Coupled Naphthalene Oxidation Reactions	$\Delta G°_r$ (kcal/mole naphthalene)	$\Delta G°_r$ (kJ/mole naphthalene)	Stoichiometric Mass Ratio of Electron Acceptor to Compound
$12O_2 + C_{10}H_8 \Rightarrow 10CO_2 + 4H_2O$ *Naphthalene oxidation /aerobic respiration*	-1217.40	-5094	3.00:1
$9.6NO_3^- + 9.6H^+ + C_{10}H_8 \Rightarrow 10CO_2 + 8.8H_2O + 4.8N_{2,g}$ *Naphthalene oxidation / denitrification*	-1234.04	-5163	4.65:1
$24MnO_2 + 48H^+ + C_{10}H_8 \Rightarrow 10CO_2 + 24Mn^{2+} + 28H_2O$ *Naphthalene oxidation / manganese reduction*	-1217.57	-5094	16.31:1
$48Fe(OH)_{3,a} + 96H^+ + C_{10}H_8 \Rightarrow 10CO_2 + 48Fe^{2+} + 124H_2O$ *Naphthalene oxidation / iron reduction*	-932.64	-3902	40.13:1
$6SO_4^{2-} + 12H^+ + C_{10}H_8 \Rightarrow 10CO_2 + 6H_2S^o + 4H_2O$ *Naphthalene oxidation / sulfate reduction*	-196.98	-824.2	4.50:1
$8H_2O + C_{10}H_8 \Rightarrow 4CO_2 + 6CH_4$ *Naphthalene oxidation / methanogenesis*	-44.49	-186.1	1.13:1
$24C_2Cl_4 + 20H_2O + C_{10}H_8 \Rightarrow 24C_2HCl_3 + 10CO_2 + 24H^+ + 24Cl^-$ *Naphthalene oxidation/ Tetrachloroethylene reductive dehalogenation*	-566.59	-2371	31.1:1
$24C_2HCl_3 + 20H_2O + C_{10}H_8 \Rightarrow 24C_2H_2Cl_2 + 10CO_2 + 24H^+ + 24Cl^-$ *Naphthalene oxidation/ Trichloroethylene reductive dehalogenation*	-552.91	-2313	24.6:1
$24C_2H_2Cl_2 + 20H_2O + C_{10}H_8 \Rightarrow 24C_2H_3Cl + 10CO_2 + 24H^+ + 24Cl^-$ *Naphthalene oxidation/ cis-Dichloroethylene reductive dehalogenation*	-438.67	-1835	18.2:1
$24C_2H_3Cl + 20H_2O + C_{10}H_8 \Rightarrow 24C_2H_4 + 10CO_2 + 24H^+ + 24Cl^-$ *Naphthalene oxidation/ Vinyl chloride reductive dehalogenation*	-516.67	-2162	11.6:1

Coupled 1,3,5-Trimethylbenzene Oxidation Reactions	$\Delta G°_r$ (kcal/mole 1,3,5-TMB)	$\Delta G°_r$ (kJ/mole 1,3,5-TMB)	Stoichiometric Mass Ratio of Electron Acceptor to Compound
$12O_2 + C_6H_3(CH_3)_3 \Rightarrow 9CO_2 + 6H_2O$ *1,3,5-Trimethylbenzene oxidation /aerobic respiration*	-1213.29	-5076	3.20:1
$9.6NO_3^- + 9.6H^+ + C_6H_3(CH_3)_3 \Rightarrow 9CO_2 + 10.8H_2O + 4.8N_{2,g}$ *1,3,5-Trimethylbenzene oxidation / denitrification*	-1229.93	-5146	4.96:1
$24MnO_2 + 48H^+ + C_6H_3(CH_3)_3 \Rightarrow 9CO_2 + 30H_2O + 24Mn^{2+}$ *1,3,5-Trimethylbenzene oxidation / manganese reduction*	-1213.46	-5077	17.40:1
$48Fe(OH)_{3,a} + 96H^+ + C_6H_3(CH_3)_3 \Rightarrow 9CO_2 + 48Fe^{2+} + 126H_2O$ *1,3,5-Trimethylbenzene oxidation / iron reduction*	-928.53	-3885	42.80:1
$6SO_4^{2-} + 12H^+ + C_6H_3(CH_3)_3 \Rightarrow 9CO_2 + 6H_2O + 6H_2S^o$ *1,3,5-Trimethylbenzene oxidation / sulfate reduction*	-192.87	-807.0	4.80:1
$6H_2O + C_6H_3(CH_3)_3 \Rightarrow 3CO_2 + 6CH_4$ *1,3,5-Trimethylbenzene oxidation / methanogenesis*	-40.39	-169.0	0.90:1
$24C_2Cl_4 + 18H_2O + C_6H_3(CH_3)_3 \Rightarrow 24C_2HCl_3 + 9CO_2 + 24H^+ + 24Cl^-$ *1,3,5-Trimethylbenzene oxidation/ Tetrachloroethylene reductive dehalogenation*	-562.48	-2353	33.2:1
$24C_2HCl_3 + 18H_2O + C_6H_3(CH_3)_3 \Rightarrow 24C_2H_2Cl_2 + 9CO_2 + 24H^+ + 24Cl^-$ *1,3,5-Trimethylbenzene oxidation/ Trichloroethylene reductive dehalogenation*	-548.80	-2296	26.3:1
$24C_2H_2Cl_2 + 18H_2O + C_6H_3(CH_3)_3 \Rightarrow 24C_2H_3Cl + 9CO_2 + 24H^+ + 24Cl^-$ *1,3,5-Trimethylbenzene oxidation/ cis-Dichloroethylene reductive dehalogenation*	-434.56	-1818	19.4:1
$24C_2H_3Cl + 18H_2O + C_6H_3(CH_3)_3 \Rightarrow 24C_2H_4 + 9CO_2 + 24H^+ + 24Cl^-$ *1,3,5-Trimethylbenzene oxidation/ Vinyl chloride reductive dehalogenation*	-512.56	-2145	12.4:1

TABLE 5.3
COUPLED OXIDATION REACTIONS

HAZARDOUS WASTE STORAGE AREA
AMENDED CLOSURE/POST-CLOSURE PLAN
RICKENBACKER ANGB, COLUMBUS OHIO

Coupled 1,2,4-Trimethylbenzene Oxidation Reactions	$\Delta G°_r$ (kcal/mole 1,2,4-TMB)	$\Delta G°_r$ (kJ/mole 1,2,4-TMB)	Stoichiometric Mass Ratio of Electron Acceptor to Compound
$12O_2 + C_6H_3(CH_3)_3 \Rightarrow 9CO_2 + 6H_2O$ *1,2,4-Trimethylbenzene oxidation /aerobic respiration*	-1212.92	-5075	3.20:1
$9.6NO_3^- + 9.6H^+ + C_6H_3(CH_3)_3 \Rightarrow 9CO_2 + 10.8H_2O + 4.8N_{2,g}$ *1,2,4-Trimethylbenzene oxidation / denitrification*	-1229.56	-5144	4.96:1
$24\underline{MnO_2} + 48H^+ + C_6H_3(CH_3)_3 \Rightarrow 9CO_2 + 30H_2O + 24Mn^{2+}$ *1,2,4-Trimethylbenzene oxidation / manganese reduction*	-1213.09	-5076	17.4:1
$48\underline{Fe(OH)}_{3,a} + 96H^+ + C_6H_3(CH_3)_3 \Rightarrow 9CO_2 + 48Fe^{2+} + 126H_2O$ *1,2,4-Trimethylbenzene oxidation / iron reduction*	-928.16	-3883	42.8:1
$6SO_4^{2-} + 12H^+ + C_6H_3(CH_3)_3 \Rightarrow 9CO_2 + 6H_2O + 6H_2S^o$ *1,2,4-Trimethylbenzene oxidation / sulfate reduction*	-192.50	-805.4	4.80:1
$6H_2O + C_6H_3(CH_3)_3 \Rightarrow 3CO_2 + 6CH_4$ *1,2,4-Trimethylbenzene oxidation / methanogenesis*	-40.02	-167.4	0.90:1
$24C_2Cl_4 + 18H_2O + C_6H_3(CH_3)_3 \Rightarrow 24C_2HCl_3 + 9CO_2 + 24H^+ + 24Cl^-$ *1,2,4-Trimethylbenzene oxidation/ Tetrachloroethylene reductive dehalogenation*	-562.11	-2352	33.2:1
$24C_2HCl_3 + 18H_2O + C_6H_3(CH_3)_3 \Rightarrow 24C_2H_2Cl_2 + 9CO_2 + 24H^+ + 24Cl^-$ *1,2,4-Trimethylbenzene oxidation/ Trichloroethylene reductive dehalogenation*	-548.43	-2295	26.3:1
$24C_2H_2Cl_2 + 18H_2O + C_6H_3(CH_3)_3 \Rightarrow 24C_2H_3Cl + 9CO_2 + 24H^+ + 24Cl^-$ *1,2,4-Trimethylbenzene oxidation/ cis-Dichloroethylene reductive dehalogenation*	-434.19	-1817	19.4:1
$24C_2H_3Cl + 18H_2O + C_6H_3(CH_3)_3 \Rightarrow 24C_2H_4 + 9CO_2 + 24H^+ + 24Cl^-$ *1,2,4-Trimethylbenzene oxidation/ Vinyl chloride reductive dehalogenation*	-512.19	-2143	12.4:1

Coupled Chlorobenzene Oxidation Reactions	$\Delta G°_r$ (kcal/mole Chlorobenzene)	$\Delta G°_r$ (kJ/mole Chlorobenzene)	Stoichiometric Mass Ratio of Electron Acceptor to Compound
$7O_2 + C_6H_5Cl \Rightarrow 6CO_2 + H^+ + 2H_2O + Cl^-$ *Chlorobenzene oxidation /aerobic respiration*	-731.62	-3061	2.00:1
$5.6NO_3^- + 4.6H^+ + C_6H_5Cl \Rightarrow 6CO_2 + 4.8H_2O + 2.8N_{2,g} + Cl^-$ *Chlorobenzene oxidation / denitrification*	-741.33	-3102	3.10:1
$14\underline{MnO_2} + 27H^+ + C_6H_5Cl \Rightarrow 6CO_2 + 16H_2O + 14Mn^{2+} + Cl^-$ *Chlorobenzene oxidation / manganese reduction*	-731.72	-3062	10.9:1
$28\underline{Fe(OH)}_{3,a} + 55H^+ + C_6H_5Cl \Rightarrow 6CO_2 + 72H_2O + 28Fe^{2+} + Cl^-$ *Chlorobenzene oxidation / iron reduction*	-565.51	-2366	26.8:1
$3.5SO_4^{2-} + 6H^+ + C_6H_5Cl \Rightarrow 6CO_2 + 2H_2O + 3.5H_2S^o + Cl^-$ *Chlorobenzene oxidation / sulfate reduction*	-136.38	-570.6	3.00:1
$5H_2O + C_6H_5Cl \Rightarrow 2.5CO_2 + 3.5CH_4 + H^+ + Cl^-$ *Chlorobenzene oxidation / methanogenesis*	-47.43	-198.4	0.80:1
$14C_2Cl_4 + 12H_2O + C_6H_5Cl \Rightarrow 14C_2HCl_3 + 6CO_2 + 15H^+ + 15Cl^-$ *Chlorobenzene oxidation/ Tetrachloroethylene reductive dehalogenation*	-351.99	-1473	20.7:1
$14C_2HCl_3 + 12H_2O + C_6H_5Cl \Rightarrow 14C_2H_2Cl_2 + 6CO_2 + 15H^+ + 15Cl^-$ *Chlorobenzene oxidation/ Trichloroethylene reductive dehalogenation*	-344.01	-1439	16.4:1
$14C_2H_2Cl_2 + 12H_2O + C_6H_5Cl \Rightarrow 14C_2H_3Cl + 6CO_2 + 15H^+ + 15Cl^-$ *Chlorobenzene oxidation/ cis-Dichloroethylene reductive dehalogenation*	-277.37	-1161	12.1:1
$14C_2H_3Cl + 12H_2O + C_6H_5Cl \Rightarrow 14C_2H_4 + 6CO_2 + 15H^+ + 15Cl^-$ *Chlorobenzene oxidation/ Vinyl chloride reductive dehalogenation*	-322.87	-1351	7.75:1

TABLE 5.3
COUPLED OXIDATION REACTIONS

HAZARDOUS WASTE STORAGE AREA
AMENDED CLOSURE/POST-CLOSURE PLAN
RICKENBACKER ANGB, COLUMBUS OHIO

Coupled Vinyl Chloride Oxidation Reactions	ΔG°_r (kcal/mole vinyl chloride)	ΔG°_r (kJ/mole vinyl chloride)	Stoichiometric Mass Ratio of Electron Acceptor to Compound
$2.5O_2 + C_2H_3Cl \Rightarrow 2CO_2 + H_2O + H^+ + Cl^-$ *Vinyl Chloride oxidation /aerobic respiration*	-288.98	-1209	1.29:1
$2NO_3^- + H^+ C_2H_3Cl \Rightarrow 2CO_2 + 2H_2O + Cl^- + N_{2,g}$ *Vinyl Chloride oxidation / denitrification*	-292.44	-1224	2.00:1
$5\underline{MnO_2} + 9H^+ + C_2H_3Cl \Rightarrow 2CO_2 + 6H_2O + 5Mn^{2+} + Cl^-$ *Vinyl Chloride oxidation / manganese reduction*	-289.01	-1209	7.02:1
$10\underline{Fe(OH)}_{3,a} + 19H^+ + C_6H_3(CH_3)_3 \Rightarrow 2CO_2 + 10Fe^{2+} + 26H_2O + Cl^-$ *Vinyl Chloride oxidation / iron reduction*	-229.65	-960.9	17.3:1
$1.25SO_4^{2-} + 1.5H^+ + C_2H_3Cl \Rightarrow 2CO_2 + H_2O + 1.25H_2S^o + Cl^-$ *Vinyl Chloride oxidation / sulfate reduction*	-76.40	-319.7	1.94:1
$1.5H_2O + C_2H_3Cl \Rightarrow .75CO_2 + 1.25CH_4 + H^+ + Cl^-$ *Vinyl Chloride oxidation / methanogenesis*	-44.62	-186.7	0.44:1
$5C_2Cl_4 + 4H_2O + C_2H_3Cl \Rightarrow 5C_2HCl_3 + 2CO_2 + 6H^+ + 6Cl^-$ *Vinyl Chloride oxidation/ Tetrachloroethylene reductive dehalogenation*	-153.39	-641.8	13.4:1
$5C_2HCl_3 + 4H_2O + C_2H_3Cl \Rightarrow 5C_2H_2Cl_2 + 2CO_2 + 6H^+ + 6Cl^-$ *Vinyl Chloride oxidation/ Trichloroethylene reductive dehalogenation*	-150.54	-629.9	10.6:1
$5C_2H_2Cl_2 + 4H_2O + C_2H_3Cl \Rightarrow 5C_2H_3Cl + 2CO_2 + 6H^+ + 6Cl^-$ *Vinyl Chloride oxidation/ cis-Dichloroethylene reductive dehalogenation*	-126.74	-530.3	7.82:1

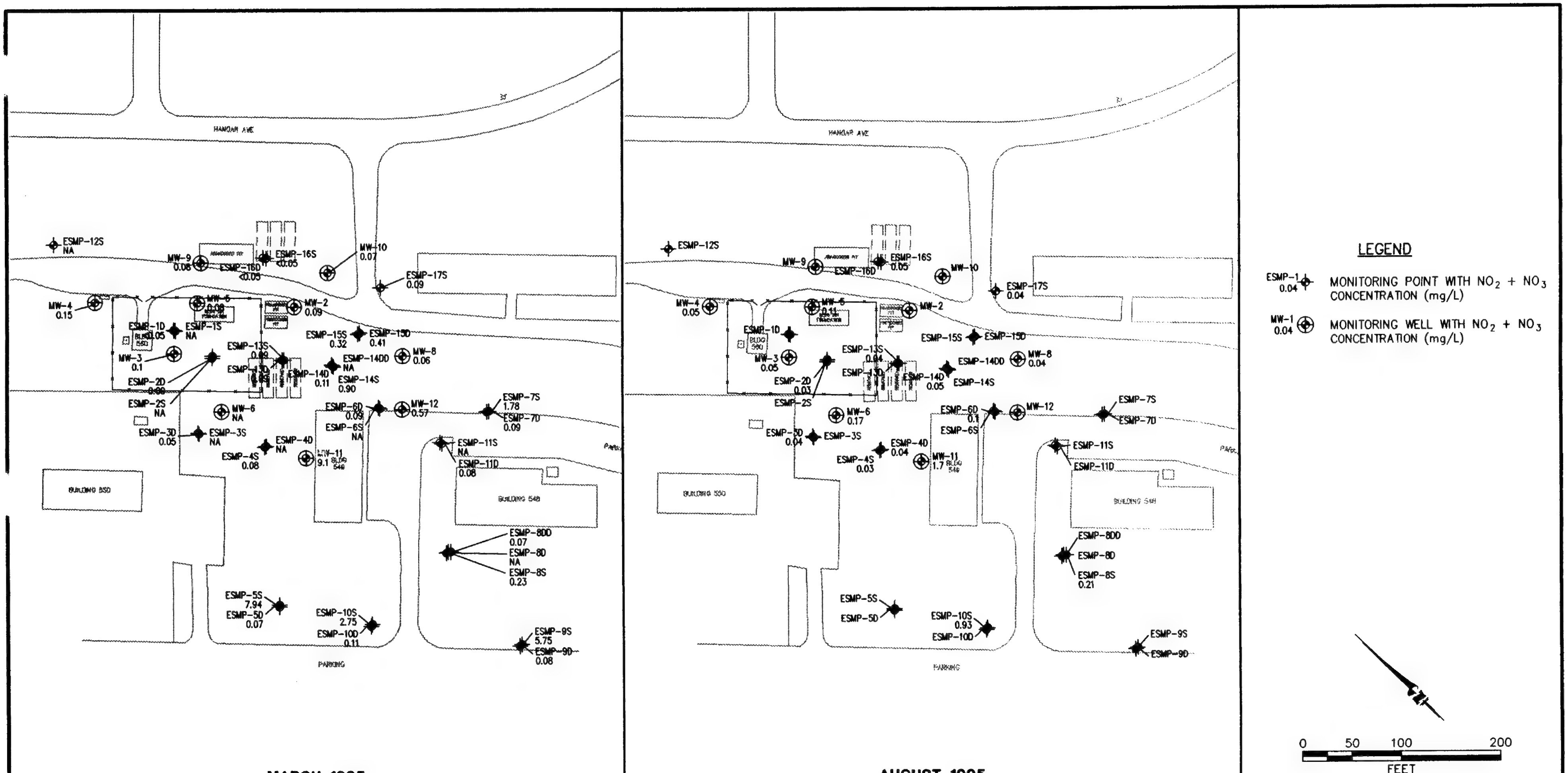

FIGURE 5.3

ESTIMATED EXTENT OF NO_2+ NO_3

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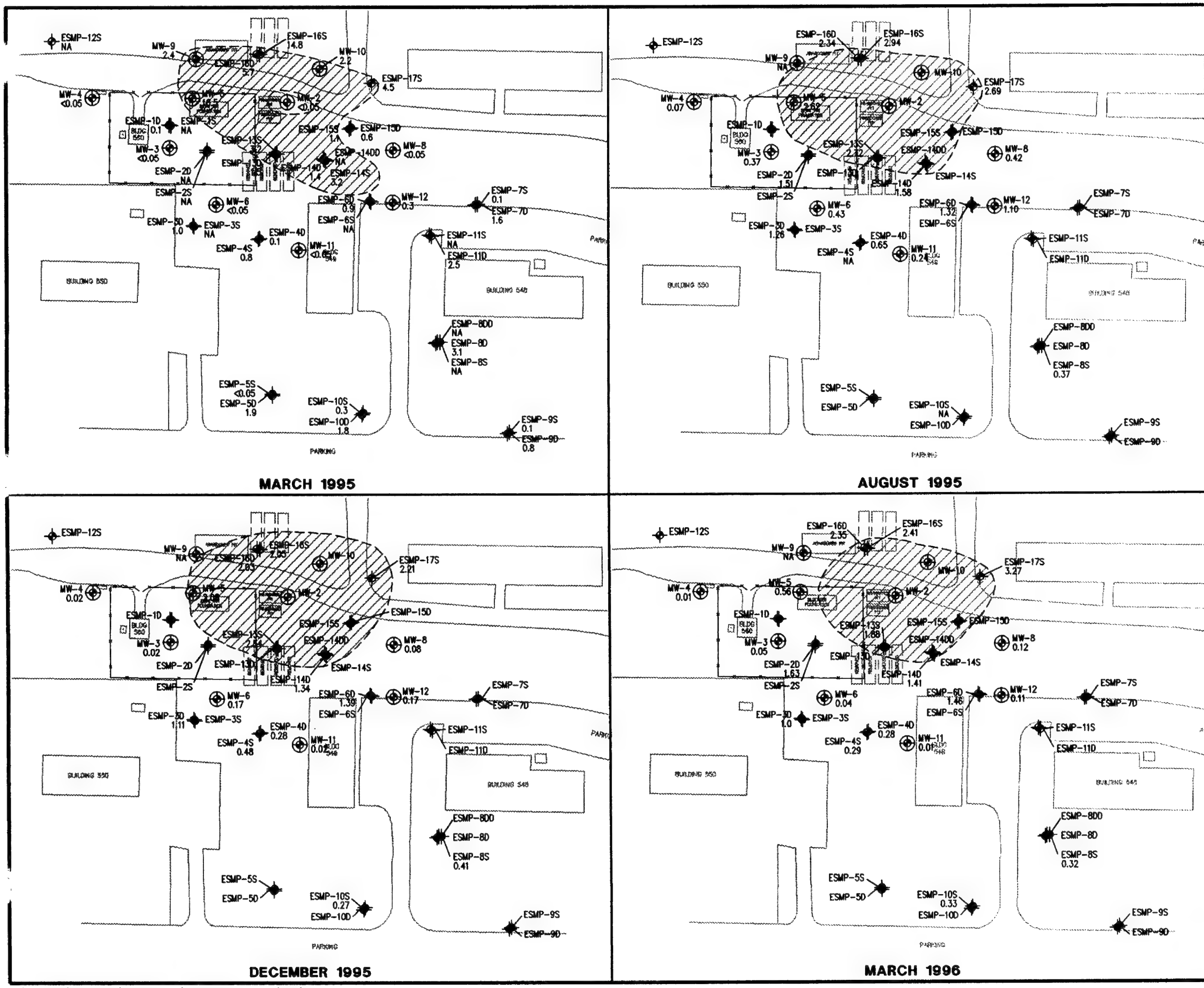
In the absence of microbial cell production, the stoichiometry of BTEX mineralization to carbon dioxide, water, and nitrogen caused by denitrification is presented in Table 5.3. The average mass ratio of nitrate to total BTEX is approximately 4.9 to 1. This translates to the mineralization of approximately 0.20 mg of BTEX for every 1.0 mg of nitrate consumed. On the basis of a background nitrate/nitrite concentration of 9.1 mg/L, the shallow groundwater at this site has the capacity to assimilate 1.90 mg/L (1,900 μg/L) of total BTEX through denitrification.

5.4.1.3 Ferrous Iron

Ferrous iron (Fe^{2+}) concentrations were measured in groundwater samples collected in 1995 and 1996. The results are presented in Figure 5.4. Measured concentrations of ferrous iron range from <0.05 mg/L to 16.5 mg/L. The highest concentrations of ferrous iron are found in two of the three sample locations with the highest total BTEX concentrations. The correlation between the area of highest BTEX concentrations and the area of elevated ferrous iron concentrations suggests that ferric iron (Fe^{3+}) hydroxide is being reduced to ferrous iron during biodegradation of BTEX compounds. Background levels of ferrous iron were below the detection limit of 0.05 mg/L, while concentrations were as high as 14.8 mg/L (ESMP-16S) and 16.5 mg/L (MW-5) at two of the wells with high BTEX concentrations.

The stoichiometry of BTEX oxidation to carbon dioxide, ferrous iron, and water by iron reduction through anaerobic microbial biodegradation is presented in Table 5.3. On average, 37.5 moles of ferric iron hydroxide are required to metabolize one mole of total BTEX. Conversely, an average of 37.5 moles of ferrous iron are produced for each mole of total BTEX consumed. On a mass basis, this translates to approximately 21.8 mg ferrous iron produced for each 1 mg of total BTEX metabolized. Given a background ferrous iron concentration of less than 0.05 mg/L and a February/March 1995 maximum detected ferrous iron concentration of 14.8 mg/L, the shallow groundwater was expressing the capacity to assimilate approximately 0.68 mg/L (680 μg/L) of total BTEX through iron reduction. This is a conservative estimate of the assimilative capacity of iron because this calculation is based on observed ferrous iron concentrations and not on the amount of ferric hydroxide available in the aquifer and solid soil matrix. Therefore, iron assimilative capacity could be much higher.

Recent evidence suggests that the reduction of ferric iron to ferrous iron cannot proceed at all without microbial mediation (Lovley and Phillips, 1988; Lovley *et al.*, 1991; Chapelle, 1993). None of the common organic compounds found in low-temperature, neutral, reducing groundwater could reduce ferric oxyhydroxides to ferrous iron under sterile laboratory conditions (Lovley *et al.*, 1991). This means that the reduction of ferric iron requires microbial mediation by microorganisms with the appropriate enzymatic capabilities. Because the reduction of ferric iron cannot proceed without microbial intervention, the elevated concentrations of ferrous iron that were measured in the contaminated groundwater at the site are very strong indicators of microbial activity.



LEGEND

ESMP-1 1.56 — MONITORING POINT WITH Fe^{2+} CONCENTRATION mg/L)

MW-1 0.24 — MONITORING WELL WITH Fe^{2+} CONCENTRATION mg/L)

NA — NOT AVAILABLE

0 50 100 200
FEET

FIGURE 5.4

ESTIMATED EXTENT OF Fe^{2+} CONCENTRATIONS >2 mg/L IN GROUNDWATER

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5.4.1.4 Sulfate

Concentrations of sulfate were measured in groundwater samples collected in 1995. Sulfate concentrations range from 6.57 mg/l to 938 mg/l. Figure 5.5 is an isopleth map showing the areal extent of sulfate in groundwater during different 1995 sampling events. The lowest measured concentration of sulfate occurs at MW-5, which is the location where free product has been measured both historically and in 1995. A depleted sulfate concentration also occurs at ESMP-13S, which contained the highest concentration of total BTEX in 1995. This high background sulfate concentration represents a significant potential for sulfate reduction as a pathway for biodegradation of the BTEX measured at this location. The correspondence between depleted sulfate and high BTEX at MW-5 and ESMP-13S is an indication the anaerobic biodegradation of BTEX compounds is occurring in the shallow groundwater through the microbially mediated process of sulfate reduction.

The stoichiometry of BTEX mineralization to carbon dioxide, sulfur, and water by sulfate reduction through anaerobic microbial biodegradation is presented in Table 5.3. The average mass ratio of sulfate to total BTEX is approximately 4.7 to 1. This translates to the mineralization of approximately 0.21 mg of total BTEX for every 1.0 mg of sulfate consumed. Assuming a background sulfate concentration of 1443 mg/L, as measured at ESMP-4S in February/March 1995, a conservative estimate of the assimilative capacity of the shallow groundwater at this site is 28.86 mg/L (28,860 µg/L) of total BTEX through sulfate reduction. Because biomass accumulation is not considered, the actual assimilative capacity attributable to sulfate could be somewhat higher.

5.4.1.5 Methane

Methane concentrations were measured in groundwater samples collected in 1995 and 1996. The results are presented in Figure 5.6. Methane concentrations range from below the quantification limit of 0.001 mg/l to 19.2 mg/l. Elevated concentrations of methane correspond well with the relatively high concentrations of total BTEX measured at MW-5, ESMP-13S, and ESMP-16S. These relations are a strong indication that anaerobic biodegradation of BTEX compounds is occurring via methanogenesis at the site. This is consistent with the electron acceptor data discussed above, with a lack of DO throughout the area, and the correlation of high BTEX concentrations with depleted nitrate/nitrite, elevated ferrous iron and methane, and reduced sulfate.

The stoichiometry of BTEX oxidation to carbon dioxide and methane by methanogenesis is presented in Table 5.3. On average, approximately 1 mg of total BTEX is degraded for every 0.78 mg of methane produced. Given a February/March 1995 detected methane concentration of 7.83 mg/L at ESMP-13S, the shallow groundwater has the expressed capacity to assimilate approximately 10.0 mg/L (10,000 µg/L) of total BTEX through methanogenesis. This is a conservative estimate

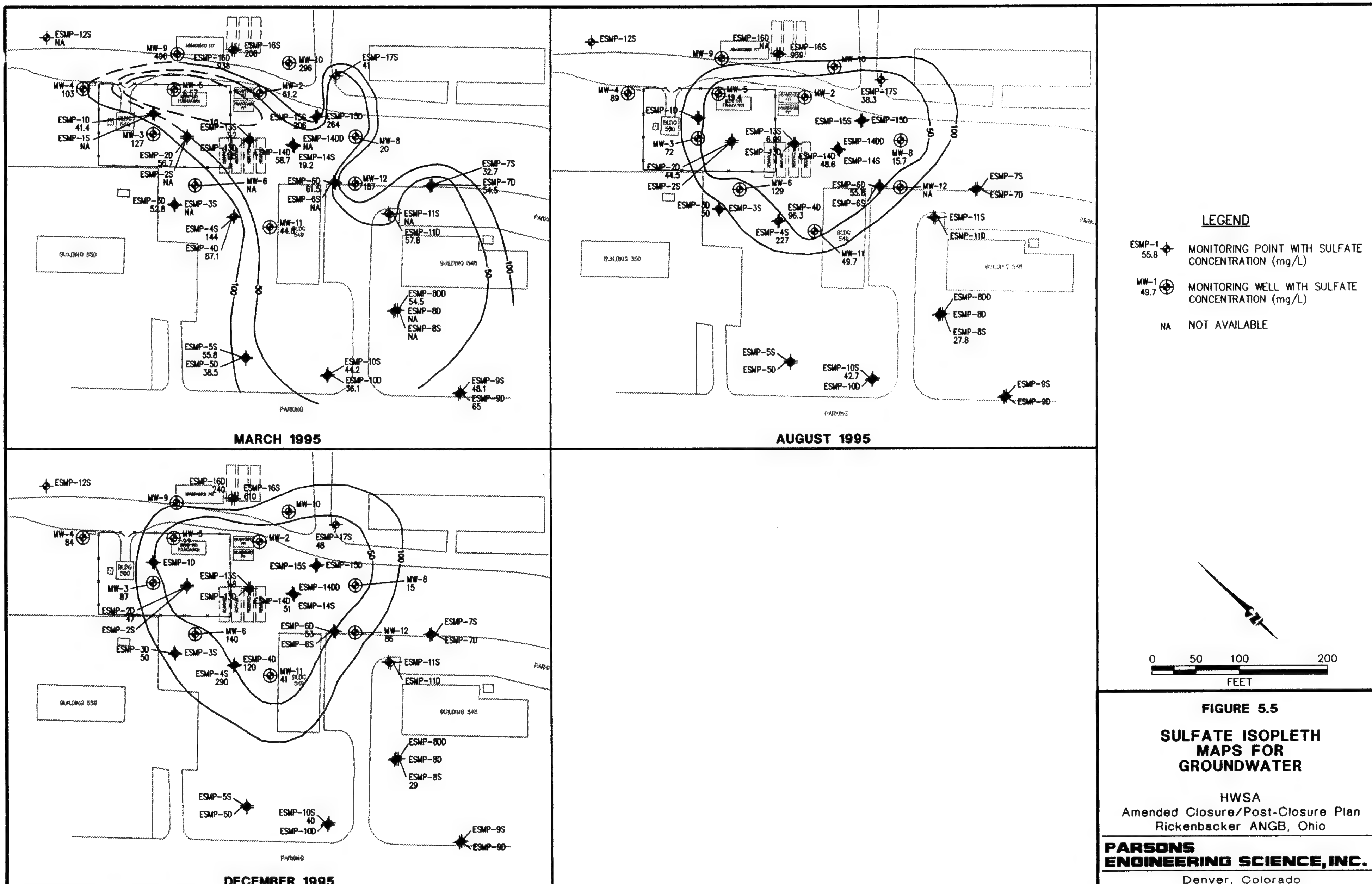

FIGURE 5.5

SULFATE ISOPLETH MAPS FOR GROUNDWATER

HWSA
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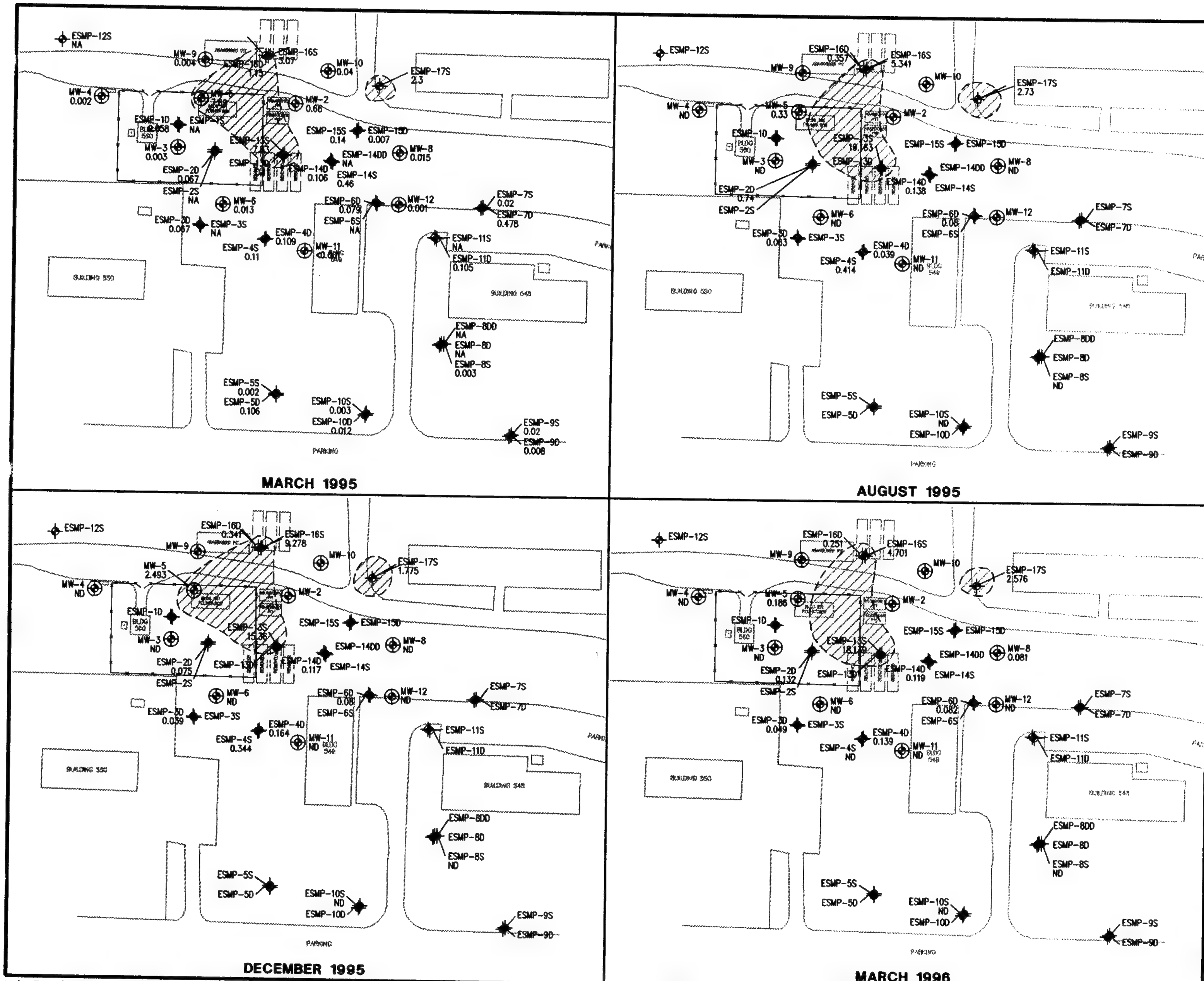

LEGEND

ESMP-1 0.14 — MONITORING POINT WITH METHANE CONCENTRATION (mg/L)

MW-1 0.015 — MONITORING WELL WITH METHANE CONCENTRATION (mg/L)

ND — NOT DETECTED

0 50 100 200
FEET

FIGURE 5.6

ESTIMATED EXTENT OF METHANE >1 mg/L IN GROUNDWATER

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of the assimilative capacity through methanogenesis because these calculations are based on observed methane concentrations and not on the amount of carbon dioxide (the electron acceptor in methanogenesis) available in the aquifer. As methanogenesis produces more carbon dioxide than it consumes, an unlimited supply of carbon dioxide is theoretically available once the process of methanogenesis has been initiated. Therefore, methanogenesis is limited by the rate of reaction rather than the source of electron receptors. This estimate of assimilative capacity also conservatively assumes that all of the produced methane remains in solution; however, this assumption is not realistic as the solubility limit of methane in water is approached.

5.4.1.6 Reduction/Oxidation Potential

Redox potentials were measured at groundwater monitoring wells and points in February 1995. The results are summarized in Table 5.2. Redox potential is a measure of the relative tendency of a solution to accept or transfer electrons. The redox potential of a groundwater system depends on which electron acceptors are being reduced by microbes during BTEX oxidation. The redox potential at the site ranges from 212 millivolts (mV) to -136 mV. The distribution of redox potentials is illustrated on Figure 5.7. Locations with high BTEX concentrations, low sulfate and nitrate/nitrite concentrations, and elevated ferrous iron and methane concentrations correspond with low redox potential. Several locations where BTEX was not detected but that also have low redox potential are directly downgradient of the BTEX plume. Comparison of these locations with previously discussed figures indicates a correlation between the low redox measurement and at least one of the chemical indicators discussed above. Redox potential is below -100 mV at monitoring wells and monitoring points at the site where total BTEX concentrations are greatest .

5.4.1.7 Volatile Fatty Acids

At monitoring points ESMP-13S and ESMP-13D groundwater samples were collected in February/March 1995 for volatile fatty acid analysis by USEPA scientists. This test is a gas chromatograph/mass spectrometry (GC/MS) method wherein the samples are compared to a standard mixture containing a total of 58 phenols, aliphatic acids, and aromatic acids. Compounds in the standard mixture are generally considered to result from microbial processes that break down petroleum hydrocarbons. USEPA scientists reported that the sample from ESMP-13S contained 14, and the sample from ESMP-13D contained 6 of the compounds in the standard mixture. ESMP-13S is the location with the consistently highest reported total BTEX concentration. ESMP-13D is adjacent to ESMP-13S but deeper; both monitoring points are generally downgradient from MW-5 where free product is encountered. The presence of these volatile fatty acid compounds is another indication that biodegradation of BTEX compounds is occurring at the site. Laboratory results for volatile fatty acids are included in Appendix D.

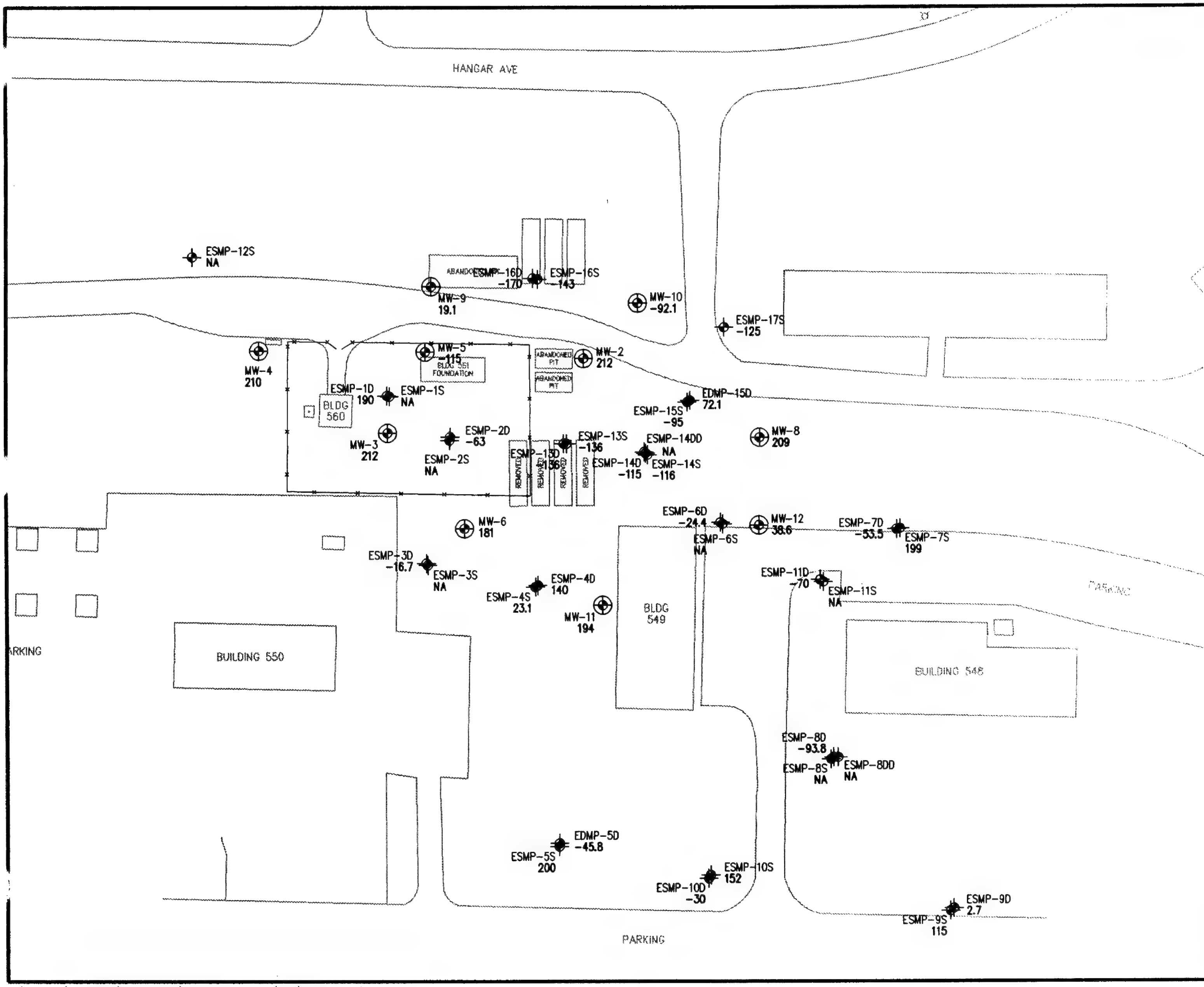

FIGURE 5.7

REDOX POTENTIAL IN GROUNDWATER

HWSA
Amended Closure/Post-Closure Plan
Rickenbacker ANGB, Ohio

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5.4.1.8 Alkalinity

Total alkalinity (as calcium carbonate) was measured in groundwater samples collected in 1995 and 1996. Alkalinity is a measure of the ability of groundwater to buffer changes in pH caused by the addition of biologically generated acids. Total alkalinity at the site is in the moderate range for groundwater, varying from 212 mg/L (ESMP-7D) to 426 mg/L (ESMP-10D). This amount of alkalinity should be sufficient to buffer potential changes in pH caused by biologically mediated BTEX oxidation reactions.

5.4.1.9 pH

pH was measured in groundwater samples collected in 1995 and 1996. The pH of a solution is the negative logarithm of the hydrogen ion concentration $[H^+]$. Groundwater pH measured at the site ranges from 6.9 to 8.2. This range of pH is within the optimal range for BTEX-degrading microbes.

5.4.1.10 Temperature

Groundwater temperature was measured at groundwater monitoring points and monitoring wells in 1995 and 1996. Temperature affects the types and growth rates of bacteria that can be supported in the groundwater environment, with higher temperatures generally resulting in higher growth rates. Temperatures in the shallow aquifer varied from 8.2 degrees Celsius (°C) to 15.3°C. These are moderate temperatures for shallow groundwater, suggesting that bacterial growth rates should not be inhibited.

5.4.1.11 Discussion

Numerous laboratory and field studies have shown that hydrocarbon-degrading bacteria can participate in the degradation of many of the chemical components of jet fuel and gasoline, including the BTEX compounds (e.g., Jamison *et al.*, 1975; Atlas, 1981, 1984, 1988; Gibson and Subramanian, 1984; Reinhard *et al.*, 1984; Young, 1984; Bartha, 1986; Wilson *et al.*, 1986, 1987, and 1990; Barker *et al.*, 1987; Baedecker *et al.*, 1988; Lee, 1988; Chiang *et al.*, 1989; Grbic-Galic, 1989 and 1990; Cozzarelli *et al.*, 1990; Leahy and Colewell, 1990; Altenschmidt and Fuchs, 1991; Alvarez and Vogel, 1991; Baedecker and Cozzarelli, 1991; Ball *et al.*, 1991; Bauman, 1991; Borden, 1991; Brown *et al.*, 1991; Edwards *et al.*, 1991 and 1992; Evans *et al.*, 1991a and 1991b; Haag *et al.*, 1991; Hutchins and Wilson, 1991; Hutchins *et al.*, 1991a and 1991b; Beller *et al.*, 1992; Bouwer, 1992; Edwards and Grbic-Galic, 1992; Thierrin *et al.*, 1992; Malone *et al.*, 1993; Davis *et al.*, 1994). Biodegradation of fuel hydrocarbons can occur when an indigenous population of hydrocarbon-degrading microorganisms is present in the aquifer and sufficient concentrations of electron acceptors and nutrients, including fuel hydrocarbons, are available to these organisms.

Comparison of the distribution of BTEX, electron acceptor, and biodegradation byproducts at the site provides strong qualitative evidence of biodegradation of BTEX compounds. The distributions of these suggest that five electron acceptors are active in the biodegradation of BTEX compounds at the site: DO, ferric iron (indicated by the presence of ferrous iron), sulfate, nitrate, and carbon dioxide (indicated by the presence of methane). Typically, zones of elevated methane concentration, depleted sulfate concentration, depleted nitrate concentration, and elevated ferrous iron concentration coincide with the location of the BTEX plume.

5.4.1.12 Expressed Assimilative Capacity

The data presented in the preceding sections suggest that mineralization of BTEX compounds is occurring through the microbially mediated processes of aerobic respiration, iron reduction, sulfate reduction, nitrate reduction, and methanogenesis. On the basis of the stoichiometry presented in Table 5.3, the expressed BTEX assimilative capacity of groundwater at the HWSA during several different sampling events is presented in Table 5.4. The changes in the assimilative capacity over time suggest that biodegradation reactions are progressing, and that residual hydrocarbon contamination is being mineralized.

A closed system with two liters of water can be used to help visualize the physical meaning of assimilative capacity. Assume that the first liter contains no fuel hydrocarbons, but it contains fuel degrading microorganisms and has an assimilative capacity of exactly "*x*"μg of fuel hydrocarbons. The second liter has no assimilative capacity; however, it contains fuel hydrocarbons. As long as these two liters of water are kept separate, biodegradation of the fuel hydrocarbons will not occur. If these two liters are combined in a closed system, biodegradation will commence and continue until the fuel hydrocarbons are depleted, the electron acceptors are depleted, or the environment becomes acutely toxic to the fuel degrading microorganisms. Assuming a non-lethal environment, if fewer than "*x*" μg of fuel hydrocarbons were in the second liter, all of the fuel hydrocarbons will eventually degrade given a sufficient time; likewise, if greater than "x" μg of fuel hydrocarbons were in the second liter of water, only "*x*" μg of fuel hydrocarbons would ultimately degrade.

The groundwater beneath a site is an open system, which continually receives additional electron receptors from the flow of the aquifer and the percolation of precipitation. This means that the assimilative capacity is not a fixed entity as it is in a closed system, and therefore cannot be compared directly to contaminant concentration in the groundwater. Rather, the expressed assimilative capacity of groundwater is intended to serve as a qualitative tool. Although the expressed assimilative capacity at this site is greater than the highest measured total BTEX concentration, the fate of BTEX in groundwater and the potential impact to receptors is dependent on the relationship between the kinetics of biodegradation and the solute transport velocity (Chappelle, 1994). This significant expressed assimilative capacity is a strong indicator

TABLE 5.4
ESTIMATE OF EXPRESSED ASSIMILATIVE CAPACITY OF SATURATED SOIL AND GROUNDWATER
HAZARDOUS WASTE STORAGE AREA
AMENDED CLOSURE/POST-CLOSURE PLAN
RICKENBACKER ANGB, OHIO

Electron Acceptor	Background Concentration[a] (µg/L)	Utilized Electron Acceptor Mass (µg/L)	BTEX Assimilative Capacity[b] (µg/L)
February/ March 1995			
Dissolved Oxygen	3,900	3,900	1,248
Nitrate	9,100	9,050	1,901
Ferrous iron[c]	50	14,750	677
Sulfate	144,000	137,430	28,860
Methane[c]	1	7,829	10,005
TCE[d]	9,580	9,579	1,533
DCE[c/d]	920	4,145	219
		Total Assimilative Capacity	44,443
		Maximum BTEX	963
August 1995			
Dissolved Oxygen	4,700	4,300	1,376
Nitrate	1,700	1,650	347
Ferrous iron[c]	240	2,700	124
Sulfate	227,000	220,910	46,391
Methane[c]	0	19,163	24,489
TCE[d]	770	770	123
DCE[c/d]	0	7,730	409
		Total Assimilative Capacity	73,259
		Maximum BTEX	430
December 1995			
Dissolved Oxygen	5,800	5,300	1,696
Nitrate	2,900	2,900	609
Ferrous iron[c]	20	2,520	116
Sulfate	290,000	288,200	60,522
Methane[c]	0	15,360	19,629
TCE[d]	180	180	29
DCE[c/d]	28	4,472	236
		Total Assimilative Capacity	82,837
		Maximum BTEX	410

[a] Background concentrations determined using data from wells MW-11and ESMP-4S.

[b] Calculated based on the ratio of the total mass of electron acceptor required to oxidize a given mass of total benzene, toluene, ethylbenzene, and xylenes (BTEX), assuming no other source of oxidizing demand.

[c] This represents the reduced form of the electron acceptor. Assimilative capacity is expressed only as an estimate.

[d] Chlorinated VOCs can be used as alternate electron acceptors in the oxidation of BTEX compounds. Background concentrations for VOC were determined from MW-6.

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that biodegradation is occurring; however, it is not an indication that biodegradation will proceed to completion before potential downgradient receptors are impacted.

At the HWSA, the groundwater appears to have sufficient assimilative capacity to degrade the observed dissolved BTEX and limit plume migration. However, a small but unknown quantity of LNAPL is available to continually replenish dissolved BTEX concentrations. As the LNAPL is body is highly weathered and believed to be of very limited extent, and the configuration of the groundwater surface suggests that dissolved BTEX will be inhibited from migrating offsite, natural attenuation of BTEX in groundwater is considered to be sufficient to remediate the low concentrations of BTEX observed at the site.

5.4.2 Degradation of Chlorinated Solvents

Chlorinated solvents can be transformed, directly or indirectly, by biological processes (e.g., Bouwer *et al.*, 1981; Wilson and Wilson, 1985; Miller and Guengerich, 1982; Nelson *et al.*, 1986; Bouwer and Wright, 1988; Little *et al.*, 1988; Mayer *et al.*, 1988; Arciero *et al.*, 1989; Cline and Delfino, 1989; Freedman and Gossett, 1989; Folsom *et al.*, 1990; Harker and Kim, 1990; Alvarez-Cohen and Mccarty, 1991a, 1991b; Destefano *et al.*, 1991; Henry, 1991; Mccarty *et al.*, 1992; Hartmans and de Bont, 1992; Mccarty and Semprini, 1994; Vogel, 1994). Biodegradation of **chlorinated aliphatic hydrocarbons** (CAHs), while similar in principle to biodegradation of BTEX, typically results from a more complex series of processes.

Whereas BTEX is biodegraded in essentially one step by acting as an electron donor/carbon source, CAHs may undergo several types of biodegradation involving several steps. CAHS may undergo biodegradation through three different pathways: use as an electron acceptor, use as an electron donor, or cometabolism, which is degradation resulting from exposure to a catalytic enzyme fortuitously produced during an unrelated process. At a given site, one or all of these processes may be operating, although at many sites the use of CAHs as electron acceptors appears to be the most likely.

In a pristine aquifer, native organic carbon is utilized as an electron donor and DO is utilized first as the prime electron acceptor. Where anthropogenic carbon (e.g., fuel hydrocarbons or low-molecular-weight CAHs) is present, it also will be utilized as an electron donor. After the DO is consumed, anaerobic microorganisms typically use native electron acceptors (as available) in the following order of preference: nitrate, ferric iron oxyhydroxide, sulfate, and finally carbon dioxide. Evaluation of the distribution of these electron acceptors can provide evidence of where and how CAH biodegradation is occurring. In addition, because CAHs may be used as electron acceptors or electron donors (in competition with other acceptors or donors), isopleth maps showing the distribution of these compounds will also provide evidence on the types of biodegradation processes acting at a site.

As with BTEX, the driving force behind redox reactions resulting in CAH degradation is electron transfer. Although thermodynamically favorable, most of the reactions involved in CAH reduction and oxidation cannot proceed abiotically because of the lack of activation energy. Microorganisms are capable of providing the necessary activation energy; however, they will facilitate only those reduction/oxidation (redox) reactions that have a net yield of energy (i.e. $\Delta G°_r < 0$). A more complete description of the main types of biodegradation reactions affecting CAHs is presented in the following subsections.

5.4.2.1 Electron Acceptor Reactions (Reductive Dehalogenation)

Under anaerobic conditions, biodegradation of chlorinated solvents usually proceeds through a process called reductive dehalogenation. During this process, the halogenated hydrocarbon is used as an electron acceptor, not as a source of carbon, and a halogen atom is removed and replaced with a hydrogen atom. In general, reductive dehalogenation occurs by sequential dehalogenation from TCE to DCE to vinyl chloride to ethene. Depending upon environmental conditions, this sequence may be interrupted, with other processes then acting upon the products. During reductive dehalogenation, all three isomers of DCE can theoretically be produced; however, Bouwer (1994) reports that under the influence of biodegradation, *cis*-1,2-DCE is a more common intermediate than *trans*-1,2-DCE, and that 1,1-DCE is the least prevalent intermediate of the three DCE isomers. Reductive dehalogenation of chlorinated solvent compounds is associated with the accumulation of daughter products and an increase in chloride.

Reductive dehalogenation affects each of the chlorinated ethenes differently. Of these compounds, PCE is the most susceptible to reductive dehalogenation because it is the most oxidized. Conversely, vinyl chloride is the least susceptible to reductive dehalogenation because it is the least oxidized of these compounds. The rate of reductive dehalogenation also has been observed to decrease as the degree of chlorination decreases (Vogel and Mccarty, 1985; Bouwer, 1994). Murray and Richardson (1993) have postulated that this rate decrease may explain the accumulation of vinyl chloride in TCE plumes that are undergoing reductive dehalogenation.

In addition to being affected by the degree of chlorination of the CAH, reductive dehalogenation can also be controlled by the redox conditions of the site groundwater system. In general, reductive dehalogenation has been demonstrated under anaerobic nitrate- and sulfate-reducing conditions, but the most rapid biodegradation rates, affecting the widest range of CAHs, occur under methanogenic conditions (Bouwer, 1994). Dehalogenation of PCE and TCE to DCE can proceed under mildly reducing conditions such as nitrate reduction or iron (III) reduction (Vogel *et al.*, 1987), while the transformation of DCE to vinyl chloride, or the transformation from vinyl chloride to ethene requires more strongly reducing conditions (Freedman and Gossett, 1989; Destefano *et al.*, 1991; Bebrunin *et al.*, 1992).

Because CAH compounds are used as electron acceptors, there must be an appropriate source of carbon for microbial growth in order for reductive dehalogenation to occur (Bouwer, 1994). Potential carbon sources can include low-molecular-weight compounds (e.g., lactate, acetate, methanol, or glucose) present in natural organic matter, or fuel hydrocarbons such as BTEX.

5.4.2.2 Electron Donor Reactions

Under aerobic conditions some CAH compounds can be utilized as the primary substrate (i.e., electron donor) in biologically mediated redox reactions (Mccarty and Semprini, 1994). In this type of reaction, the facilitating microorganism obtains energy and organic carbon from the degraded CAH. In contrast to reactions in which the CAH is used as an electron acceptor, only the least oxidized CAHs can be utilized as electron donors in biologically mediated redox reactions. Davis and Carpenter (1990) describe the aerobic oxidation of vinyl chloride in groundwater. Mccarty and Semprini (1994) describe investigations in which vinyl chloride was shown to serve as a primary substrate. These authors also document that dichloromethane has the potential to function as a primary substrate under either aerobic or anaerobic environments. In addition, Bradley and Chapelle (1996) show evidence of oxidation of vinyl chloride under iron-reducing conditions so long as there is sufficient bioavailable iron (III). Murray and Richardson (1993) write that microorganisms are generally believed to be incapable of growth using TCE and PCE. Aerobic metabolism of vinyl chloride may be characterized by a loss of vinyl chloride mass, a decreasing molar ratio of vinyl chloride to other CAH compounds, and the presence of chloromethane.

5.4.2.3 Cometabolism

When a CAH is biodegraded through cometabolism, it serves as neither an electron acceptor nor a primary substrate in a biologically mediated redox reaction. Instead, the degradation of the CAH is catalyzed by an enzyme or cofactor that is fortuitously produced by organisms for other purposes. The organism receives no known benefit from the degradation of the CAH; rather the cometabolic degradation of the CAH may in fact be harmful to the microorganism responsible for the production of the enzyme or cofactor (Mccarty and Semprini, 1994).

Cometabolism is best documented in aerobic environments, although it potentially could occur under anaerobic conditions. It has been reported that under aerobic conditions chlorinated ethenes, with the exception of PCE, are susceptible to cometabolic degradation (Murray and Richardson, 1993; Vogel, 1994; Mccarty and Semprini, 1994). Vogel (1994) further elaborates that the cometabolism rate increases as the degree of dehalogenation decreases.

In the cometabolic process, TCE is indirectly transformed by bacteria as they use BTEX or another substrate to meet their energy requirements. Therefore, TCE does not enhance the degradation of BTEX or other carbon sources, nor will its cometabolism interfere with the use of electron acceptors involved in the oxidation of

those carbon sources. It is likely that depletion of suitable substrates (BTEX or other organic carbon sources) may limit cometabolism of CAHs.

5.4.2.4 Discussion

At the HWSA, the principal BTEX degradation processes include methanogenesis, iron reduction, sulfate reduction, and nitrate/nitrite reduction. The occurrence of these processes indicates that environmental conditions at the HWSA site may be suitable to support rapid reductive dehalogenation of highly chlorinated compounds such as TCE and DCE. However, the accumulation of vinyl chloride is possible under these conditions, because the rate of anaerobic dechlorination of vinyl chloride can slow dramatically.

Previous investigations at the HWSA have documented chlorinated solvent contamination consisting of TCE, 1,1-DCE, trans-1,2-DCE, VC, and 1,1,1-TCA. TCE, cis- and trans-1,2-DCE, 1,1-DCE, 1,2-DCA, vinyl chloride, and ethene were measured in groundwater samples collected from site monitoring wells and monitoring points in 1995 and 1996. Results are presented in Section 4. On the basis of the widespread use of TCE as a solvent in metal degreasing, the limited use of the other chlorinated compounds in non-industrial applications, and the presence of these compounds together on-site, it is probable that highly chlorinated solvents such as TCE are undergoing anaerobic biodegradation via reductive dehalogenation to less chlorinated solvents (DCE and vinyl chloride).

Equally as important, vinyl chloride is apparently undergoing a final transformation to ethene. The highest concentration of ethene was detected in the groundwater sample from monitoring point ESMP-17S. This groundwater sample also contained the highest concentration of vinyl chloride. Ethene was also detected at two other monitoring points (ESMP-13S and ESMP-4S), both of which contained measurable concentrations of chlorinated VOCs. These data suggest that vinyl chloride is being effectively mineralized to ethene, rather than accumulating in the subsurface. However, additional data downgradient from ESMP-17S are necessary to assess the effectiveness of natural chemical attenuation processes at bringing about complete dechlorination to ethene. Installation of additional monitoring points is recommended as part of closure activities to confirm the extent of dissolved contamination near ESMP-17 and the impact of natural chemical attenuation processes on vinyl chloride.

Applicable interim status requirements described in OAC rule 3745-66-13(b)(2) will be maintained during closure activities to prevent threats to human health and the environment. These applicable requirements include the following:

- Maintenance of site security through the upkeep of the existing fence, prevention of unauthorized entry, and preventing unnecessary physical contact with or disturbance of contaminated media;

- Training personnel involved with the site in proper hazardous waste management procedures (see Section 7);
- Maintaining communication regarding the site with local police, fire, and spill response authorities; and
- Continued groundwater monitoring to verify continued decontamination and interruption of potential exposure pathways.

In the event that natural chemical attenuation processes and/or exposure controls are determined insufficient to achieve acceptable levels in groundwater, implementation of a groundwater oxygenation system at the leading edge of the dissolved chlorinated plume could be considered. The following section generally describes the basic elements of a groundwater oxygenation system (such as air sparging).

5.5 ENGINEERED GROUNDWATER REMEDIATION

If natural chemical attenuation processes are determined to be insufficient to transform residual vinyl chloride to ethene, oxygenation of the groundwater to promote degradation and volatilization could be considered. Oxygenation of groundwater could be completed using either a passive chemical oxidant system or an active system such as air sparging. The objective of both approaches is to introduce oxygen into the contaminated aquifer material and groundwater. Treatment may occur either through volatilization or through biodegradation stimulated by adding oxygen. An increase in DO in groundwater would promote rapid aerobic oxidation of vinyl chloride.

Figure 5.8 presents a conceptual layout of a sparging system. Although sparging has been applied at numerous sites, the current understanding of sparging performance and effectiveness is limited. One potential concern is the tendency for injected or introduced oxygen to form channels in the aquifer. When one of these channels intercepts a monitoring well, the air then bubbles up through the well, stripping contaminants and oxygenating the well water. As a result, the well quickly appears clean, although much of the surrounding aquifer may remain untreated.

Assuming the leading edge of the dissolved chlorinated plume is about 80 feet in lateral extent, approximately 10 wells may be needed to deliver chemical oxidants such as peroxide or oxygen to the subsurface. A pilot study of the potential feasibility of using either passive or engineered oxygenation would need to be completed if additional site characterization data suggest that natural chemical attenuation processes need to be supplemented.

5.6 CONTINGENCY PLAN

Should the proposed remedial/closure approach fail to retard dissolved contaminant migration and/or achieve the long-term closure objectives for this site, there should be no significant impact on the land use plans for the site. No

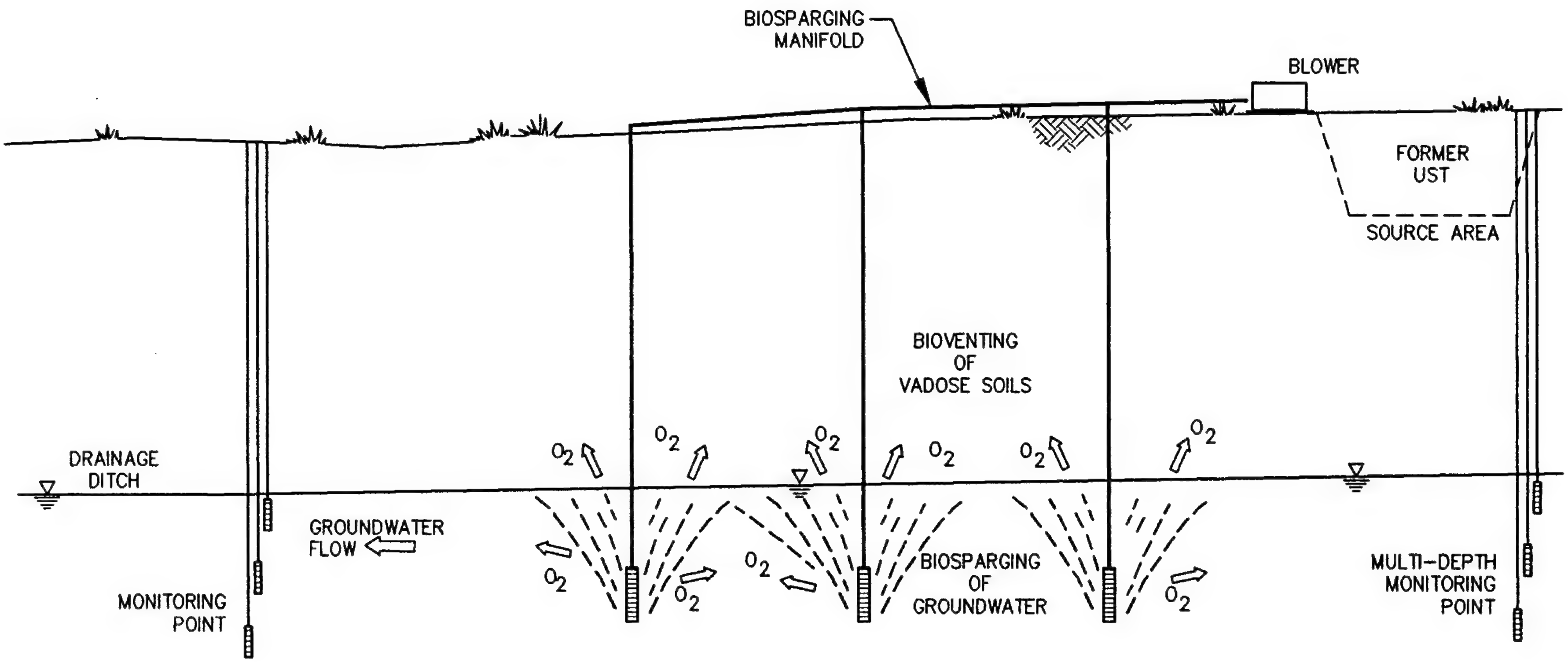

FIGURE 5.8

CONCEPTUAL BIOSPARGING SYSTEM

HWSA
Amended Closure/Post-Closure Plan
Rickenbacker ANGB, Ohio

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non-industrial land use has been proposed; the site will soon become part of taxiway to be constructed by the Portland Authority. Exposure controls will have to maintained to prevent potential receptors (e.g., onsite workers) from coming into direct contact with impacted media.

Contingency actions would only be necessary if potential receptors may be subject to unacceptable exposure and/or to expedite attainment of long-term closure objectives. Contingency actions would only need to be considered for implementation if the following events occurred:

- **The proposed soil remediation approach was not sufficient to reduce the risk associated with direct and indirect exposure to onsite soils, accounting for the long-term use of the land; or**
- **The results of at least two (2) consecutive groundwater assessment/monitoring events indicated that site-related contaminants were migrating beyond site boundaries at concentrations that could pose a potential risk to downgradient receptors; or**
- **The results of at least two (2) consecutive groundwater assessment/monitoring events indicated that biodegradation of contaminants are not proceeding at rates sufficient to either limit mobility or minimize mass/toxicity; and**
- **The proposed engineered groundwater approach (e.g., sparging) was not sufficient to promote contaminant mass/toxicity reductions or limit mobility.**

If any of these events occur, an additional assessment event will be conducted to determine the existing extent of contamination and to locate the highest zone of contamination. Once again, the failure of the proposed remedial/closure approach will not impact the current or proposed uses of the HWSA, unless groundwater must be extracted for long-term potable uses or saturated soils must be excavated (without appropriate personal protective equipment).

5.7 COVER ALTERNATIVES

The previous sections describe the closure activities deemed appropriate to pursue a risk-based closure of the HWSA. However, if additional site data such as pilot test results suggest that these approaches will not achieve the desired level of risk reduction at the site, possible contingency actions could include installation of a cover prior to taxiway construction and limited groundwater extraction and treatment. This level of remediation would be deemed excessive by most~~more~~ environmental professionals given the levels of contamination encountered at this site and the current and future uses of the land and groundwater. However, for completeness, the following sections generally prescribe the two types of covers that could be considered for implementation at this site in the event that additional action is necessary to protect potential receptors.

Responsibility for closure of the former HWSA was transferred on September 30, 1994 to the AFBCA. Large portions of the original base have been transferred to the Rickenbacker Port Authority. A long-term lease is currently being negotiated for all of this property, including the area immediately surrounding the former HWSA. This lease is anticipated to be signed by the conclusion of calendar year 1997~~6~~. Future land use of the former HWSA area as an aircraft taxiway/parking area has been identified in the land reuse plan. Additionally, the lease specifies excavation restrictions at the HWSA site. Redevelopment of the area and construction of additional infrastructure is constrained by the available funding and the schedule designated by the Rickenbacker Port Authority. Therefore, any contingency closure activities such as the construction of a long-term engineered cover must be performed in **conjunction**~~conduction~~ with the future land use of the site. Because Rickenbacker Port Authority has not yet scheduled redevelopment in this area, the detailed design and construction of a compatible engineered cover must be considered only as long-term contingency actions. The area that may require coverage with low-permeability materials would extend to cover all site-related contaminated soils to the existing fenceline.

Any contingency cover construction **will**~~may~~ need to meet the specifications of an alternative hazardous waste unit cover approved by the Ohio EPA. Because this section only conceptually describes potential contingency actions involving covers, no detailed design information is provided. Should such a cover be required, the design of all cover components would be subject to approval by the Ohio EPA. One possible contingency cover approach, called the taxiway cover herein, would tie directly into a proposed airport taxiway and would be constructed of compatible materials and grade to match the taxiway, with Ohio EPA approval of the cover specifications. The taxiway cover also would include a subsurface drainage system and a secondary hydraulic barrier to minimize the potential for surface water to infiltrate contaminated soils below the cover.

A second possible contingency cover approach would involve capping the affected area with an asphalt cover. This approach is similar to the taxiway cover with the exception that asphalt would be used as the primary hydraulic barrier instead of concrete. This approach may be suitable if contingency actions are required in advance of construction of the proposed airport taxiway. In this way, the asphalt cover could be easily converted to the taxiway cover in the future, if necessary.

The following sections present a general rationale for selection, the materials required for implementation, the primary functional components, and the installation requirements for each of the contingency covers. No detailed design elements have been included, because closure is proposed to be implemented using the methods described previously.

5.76.1 Taxiway Cover

5.76.1.1 Basis for Design

The taxiway cover may be a suitable contingency action to implement at the former HWSA based on the most probable future land use of site as an airport taxiway as indicated by representatives of the Rickenbacker Port Authority. The proposed concrete cover over the affected site area would be designed and constructed to tie into the remainder of the proposed airport taxiway, creating a continuous concrete surface that can be used for aircraft operations. A typical landfill-type cover (i.e., a raised mound with surface vegetation) over the affected area was not selected because of the relatively small area (approximately 16,000 square feet, or 0.3 acre) requiring cover and because it would break up the continuity of the taxiway.

The effectiveness of the contingency taxiway cover is expected to be high. The permeability of mature, good-quality concrete is typically on the order of 1×10^{-10} cm/sec (Portland Cement Association, 1990). The measured hydraulic conductivity of quality concrete is critically affected by the water-cement ration of the mix, and is expected to range from 1×10^{-10} cm/sec to 4×10^{-9} cm/sec for water-cement ratios of 0.4 to 0.7, respectively. In comparison, Resource Conservation and Recovery Act [RCRA] cover requirements standards require a minimum of at least a 24-inch-thick layer of compacted clay soil with a maximum hydraulic conductivity of 1×10^{-7} cm/sec, combined with a geomembrane that is at least 20-mils thick.

The concrete mix specification and QA/QC of cover construction will be fully developed in the detailed design of any contingency cover, which will then be submitted to Ohio EPA as part of an amended closure plan. The design specifications will require demonstrating that the concrete layer is equivalent to the RCRA standard of 24 inches of compacted clay with a permeability not exceeding 1×10^{-7} cm/sec. Therefore, in the event that such a contingency cover is required, the taxiway cover specifications would likely describe a minimum of 14 inches of concrete with a hydraulic conductivity **not**~~no~~ exceeding 1×10^{-8} cm/sec. This would be substantially more protective than the RCRA equivalent of 24 inches of material with a permeability not exceeding 1×10^{-7} cm/sec.

Because of the extreme loading conditions expected to be placed on the airport taxiway, the concrete mix would be designed to have high strength and low shrinkage characteristics. A minimum concrete thickness of 14 inches is anticipated for structural compatibility with the **taxiway**~~contingency cover~~. The design of the taxiway cover would ensure that the number of control joints over the affected area would be minimized, and that the necessary joints would be placed strategically to reduce the potential for concrete cracking. All of the control joints would be constructed with backer rod and caulking sealant to prevent water infiltration. In order to control the limited quantity of water that may infiltrate through the concrete cover, a subsurface drainage system and underlying secondary hydraulic barrier would be installed. These

components of the taxiway cover would ensure that surface water infiltration into the contaminated subgrade soils would be minimized. Because water would be collected in the subsurface drain system, the quantity of infiltration, hence the effectiveness of the concrete cover, could be monitored.

Periodic inspections and possibly maintenance of the cover would be required. However, because of the small cover area, these activities could be accomplished with relative ease. Maintenance of the cover may involve sealing of joints and possibly replacement of part of the concrete surfacing. Compaction of the subgrade soils prior to placement of the subsurface drain and the concrete cover would limit settlement-related maintenance requirements. Proper functioning of the subsurface drain would limit the impact of freeze-thaw effects on the cover.

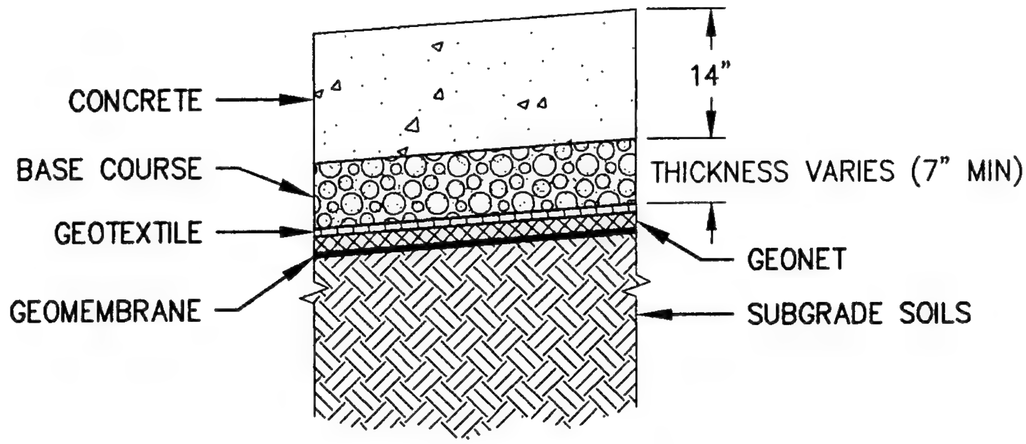
Other benefits of the taxiway cover include limited cut and fill activities, minimal to no offsite waste disposal requirements, and ease of construction. In comparison to a standard RCRA cover, the quantity of fill and the grading requirements for the taxiway cover would be negligible. Because construction methods and final surface grade elevations already would be established for the remainder of the airport taxiway, installation of the concrete cover would be significantly easier than installation of a standard RCRA cover.

5.76.1.2 Cover Materials

The layers for the taxiway cover include the same materials to be used for the remainder of the airport taxiway, with the addition of materials used to control subsurface drainage. The materials included in the cross-section of the proposed taxiway cover are presented on Figure 5.9 and include the following, listed in order of placement (i.e., from bottom to top):

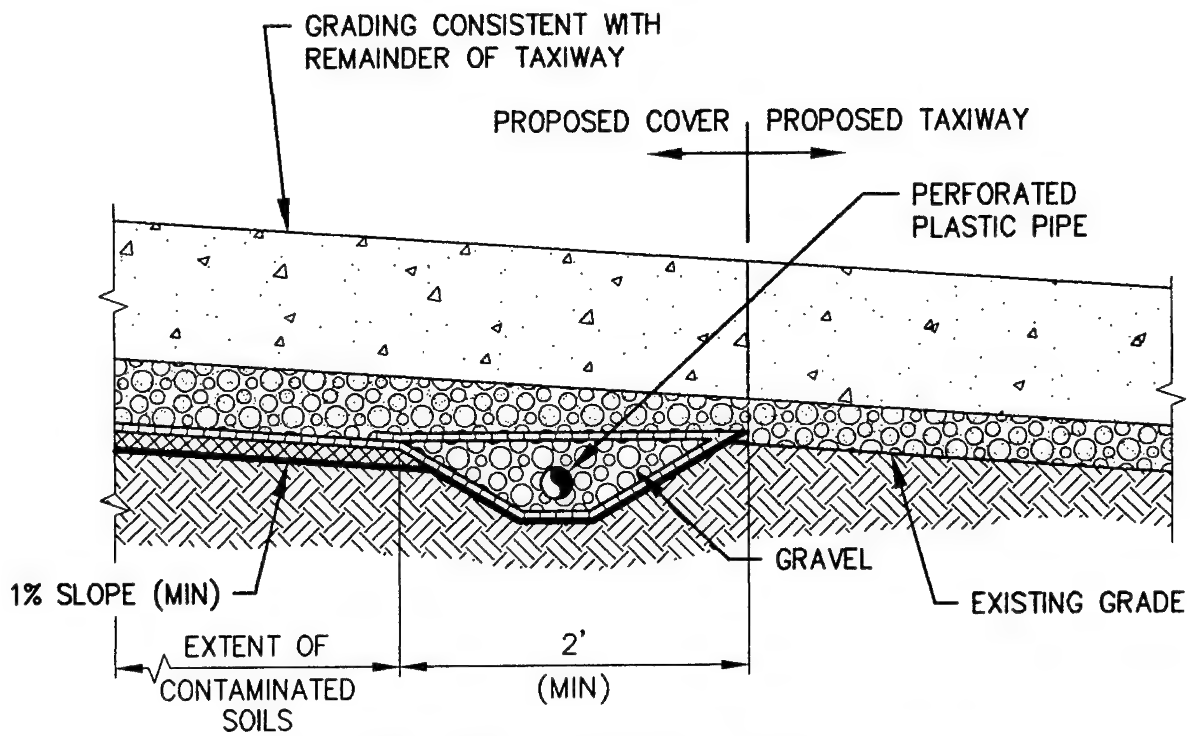
- Geomembrane (flexible, impermeable membrane liner),
- Geonet (fabricated drainage net),
- Geotextile (filter fabric),
- Base course (aggregate), and
- Concrete.

The uppermost layer would consist of at least 14 inches of concrete. This layer would act as a hydraulic barrier, restricting precipitation infiltration from reaching the



TYPICAL SECTION

NOT TO SCALE



TOE DRAIN AND DRAINAGE SWALE DETAIL

NOT TO SCALE

FIGURE 5.9

DETAILS OF CONTINGENCY TAXIWAY COVER

HWSA
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subsurface soils. A minimum of 14 inches of concrete will be placed with hydraulic conductivity not exceeding 1 x 10^{-8} cm/sec. To meet this specification, a maximum water-cement ratio will be met in the concrete mix (as specified in the detailed design for the cover). Verification of concrete hydraulic conductivity will be performed by collection of representative concrete core samples, and laboratory testing using astm d-5084 (measurement of hydraulic conductivity of saturated porous materials using a flexible wall perimeter). At least two representative core samples will also be collected across the completed control joints for laboratory testing of hydraulic conductivity using ASTM D-5084. The specified concrete mix will be consistent with the materials placed for the remainder of the proposed taxiway.

Prior to placement of the cover materials, the existing ground surface will be compacted to provide a stable base for the overlying cover. The finished subgrade surface will be smooth and evenly graded, and will be free of protruding particles or objects that may be unsuitable for installation of the overlying geomembrane. Consideration would be given to the overall surface drainage and taxiway grading plan. The minimum 1-percent slope of the subgrade would be established to allow for adequate functioning of the subsurface drainage system. This slope may be modified based on the required design capacity of the subsurface drain.

The top two layers of the taxiway cover (i.e., base course and concrete) would match the design specifications of the remainder of the proposed airport taxiway.. Because the final taxiway design has not yet been specified, the discussions presented for these two layers are brief. ~~Details regarding the design of the airport taxiway are expected to be presented by the Rickenbacker Port Authority by spring 1996~~. The remaining layers of the taxiway cover ~~alternative~~**contingency option** are described with respect to the materials used and their primary function in the following paragraphs.

Geomembrane

A geomembrane, or flexible membrane liner (FML), would be placed immediately above the graded, compacted surface soils and would function as a hydraulic barrier, restricting infiltration from reaching the underlying contaminated soils. The geomembrane would be specified to meet the Ohio EPA regulatory requirements for geosynthetic cover materials (i.e., 60-mil, linear-low-density polyethylene). In addition, the specifications for the geomembrane would be based on the strength requirements for construction-related and long-term loading conditions. Neither chemical compatibility nor settlement-related stresses at the site are expected to impact the design life of the geomembrane.

Geonet

Above the geomembrane, a geonet fabric would be placed to provide a drainage layer that promotes lateral transport of water to the downgradient edges of the affected area. This drainage layer would reduce the potential for buildup of hydraulic head on

the geomembrane, thereby minimizing the potential for downward transport of water into the contaminated subsurface soils. The geonet would be specified based on the estimated infiltration rate through the concrete and the slope of the graded surface on which the geomembrane and the overlying layers would be placed. Because of the relatively small area that requires lateral drainage, procurement and installation of the geonet should be less expensive in comparison to a sand drainage layer. In addition, geonet is proven to function as well as sand and is considered easier to install. Specification of the geonet would consider a reduced-flow capacity attributable to vertical loading from the overlying cover materials.

Geotextile

A geotextile would be placed above the geonet and below the base course layer in order to prevent fine-grained soil particles from migrating into the geonet. This would prevent clogging of the geonet, allowing it to maintain functionality over the design lifetime of the cover. The combination of the geotextile and the geonet would serve as a protective layer for the geomembrane, which otherwise could be subject to potential puncturing from the overlying base course materials. The geotextile would be specified for the final design on the basis of the particle-size gradation of the overlying base course and the strength requirements required by construction-related and long-term loading conditions. Specification of the geotextile would ensure adequate permeability and soil-filtering characteristics.

Base Course

Immediately below the concrete, a minimum of 7 inches of compacted granular base course would be placed. This layer would provide a stable foundation for the concrete surface, and also would act as a drain to move water away from the concrete to minimize the potential for freeze-thaw effects. The base course materials would be consistent with the stabilized subbase materials to be used for the remainder of the airport taxiway.

Concrete

The uppermost layer would consist of 14 inches of reinforced concrete. This layer would act as a hydraulic barrier, restricting precipitation infiltration from reaching the subsurface soils.

5.76.1.3 Subsurface Drainage System

Infiltration through the concrete layer of the proposed cover is expected to be minimal. However, small amounts of water may infiltrate through construction joints or may be transported laterally from surrounding areas. The concrete-mix specification and control joint design will be fully developed in the detailed design of this contingency cover, as needed. In order to control these waters for purposes of

minimizing hydraulic head buildup on the geomembrane and the effects of freeze-thaw, a subsurface drainage system would be incorporated into the cover design.

The subsurface drainage system, consisting of geotextile and geonet and perimeter toe drains, would be designed to direct any infiltrating water to the downgradient edges of the cover system, where it would be conveyed by toe drains to underground piping for discharge into the nearest stormwater sewer or drainage channel. **Any permitting requirements that would need to be considered as a result of this potential approach will be identified and satisfied if implementation of this contingency option becomes necessary.** Grading of the existing ground surface and installation of a geonet blanket over the geomembrane would promote drainage to the downgradient edges of the cover system. Toe drains, as shown on Figure 5.9, would be installed on the southeastern and northeastern edges of the cover system. The toe drains would consist of perforated plastic piping placed at a minimum 0.5-percent slope within gravel-filled trenches. The toe drains would join at the eastern corner of the cover system, where the drainage would combine and drop into an underground pipe that would convey the water to the nearest storm sewer or drainage channel.

5.76.1.4 Surface Water Control

The grade of the concrete cover would be consistent with the remainder of the airport taxiway, allowing for surface drainage to be controlled based on the design of the entire taxiway. It is assumed that during the design of the airport taxiway, a surface water drainage plan will be completed. The surface water drainage plan for the airport taxiway should ensure that no drop structures or drainage swales are installed within the boundaries of the cover system. It is recommended that this plan account for the presence of the proposed cover system by directing surface flow away from the cover. It is expected that the airport taxiway will be designed to eliminate ponding by establishment of an adequate grade that directs surface runoff to control structures such as drop boxes and drainage swales. A minimum of 1-percent slope of the engineered cover will be basis of design for surface water control above the HWSA. The minimum slope of the finished cover will be maintained throughout the post-closure period. Any decreases in the slope due to settling or other deterioration of the cover will be promptly corrected as part of post-closure maintenance of the contingency cover.

5.76.1.5 Installation Procedures

Installation of the contingency taxiway cover would include site preparation, installation of the subsurface drainage system, and installation of the layers consistent with the remainder of the airport taxiway (i.e., base course and concrete surfacing). Installation of the airport taxiway layers would follow procedures established for the remainder of the taxiway; therefore, this report does not discuss this construction activity in detail. Installation of the subsurface drain would include the following construction activities: site preparation; trenching for perimeter toe drains and transport

piping to the nearest storm sewer; installation of toe drain materials and related piping; and installation of the geomembrane, geonet, and geotextile layers. The construction activities associated with installation of the subsurface drain system are discussed in the following subsection.

Site preparation for the taxiway cover would consist of clearing the surface of vegetation, sharp objects, and other debris. Building 560 and the associated foundation and pavement would be removed from the site. The site would then be graded and compacted using standard earthmoving equipment.

Trenching from the eastern corner of the cover to the nearest storm sewer and along the southeastern and northeastern edges of the proposed cover for the toe drain would be required. This work would be performed using conventional trenching and earthmoving equipment. Materials excavated during the trenching would be characterized and either disposed of or used as fill material during the site grading activities. Construction of the toe drains would include laydown of the geosynthetics that line the toe drain trenches, installation of perforated plastic piping, and backfilling of the trenches with gravel. QA/QC activities would be required to ensure satisfactory trench and piping grades and to ensure that installation of the geosynthetics meets applicable manufacturers' requirements. Piping to the storm sewer would be installed following standard construction and QA/QC procedures for this type of work.

Material quality and installation of the geomembrane, geonet, and geotextile would conform to QA/QC guidelines set forth in EPA/600/R-93/182, *Quality Assurance and Quality Control for Waste Containment Facilities* (USEPA, 1993) and to the design specifications developed for the site work. Following placement of the geosynthetics, installation of the materials associated with the airport taxiway would be performed. Design specifications would ensure that the subsurface drain geosynthetics are not damaged during the taxiway construction activities. Specifications would also include requirements for surface water controls to minimize run-on to the site during construction activities. All construction activities associated with installation of the taxiway cover would conform to OSHA guidelines.

5.76.2 Asphalt Cover

5.76.2.1 Basis of Design

An asphalt cover could be a potential contingency approach for closure of the former HWSA in the event that the taxiway cover is deemed inappropriate, unnecessary, or delayed. Specific factors influencing the selection include the ease with which the alternative could be converted to an airport taxiway, the proven effectiveness of asphalt in similar applications, and the relatively small area that requires covering. This subsection discusses these factors in detail.

Because the site is likely to be used as an airport taxiway at some time in the future, special consideration was given to cover system alternatives that could be easily

converted to this type of land use. Conversion of the proposed asphalt cover would involve removal of the asphalt surfacing, possible replacement of the base course layer that functions as foundation material, and installation of concrete surfacing consistent with the remainder of the proposed airport taxiway. In contrast, conversion of a standard RCRA cover would involve complete removal of not only the cover materials, but also of the general backfill materials used to establish an adequate cover grade. In addition, following removal of the cover and fill materials, a subsurface drainage system (as described for the taxiway cover) would need to be installed prior to laydown of the foundation base course and concrete surfacing. Under the contingency asphalt cover approach, the subsurface drainage system incorporated into the design and installation of the cover could be salvaged and reused in the conversion to a concrete taxiway cover.

The effectiveness of asphalt as a hydraulic barrier is well understood, from extensive research and numerous full-scale applications (Asphalt Institute, 1976 and 1989; Battelle Pacific Northwest Laboratories, 1994). The primary factor that impacts the effectiveness of asphalt as a hydraulic barrier is aging, which can lead to cracking. Aging processes occur due to the exposure of the asphalt to ultraviolet light, freeze-thaw effects, and dynamic loading. The first factor, exposure to ultraviolet light, would be controlled at the site by application of a seal coat on the surface of the asphalt. The seal coat would protect the underlying asphalt and act as a sacrificial layer to oxidation processes. Periodic inspections of the cover would allow reapplication of seal coating as necessary. The freeze-thaw effects on the asphalt cover are expected to be minimal due to surface water and subsurface water control inherent in the design. Establishment of an adequate surface grade would ensure that no ponding occurs, and the subsurface drainage system would function to conduct subsurface water away from the bottom of the cover system. The seal coat also would minimize the infiltration of water into the asphalt layer. Dynamic loading (e.g., vehicle traffic) on the cover would be controlled by establishing vehicle access weight restrictions in the area. Traffic on this cover would be restricted to passenger vehicles such as cars and trucks. Aircraft traffic would not be allowed on the asphalt cover area. The lack of significant dynamic loading would ensure the integrity of the barrier should micro-cracks occur.

The effectiveness of asphalt is well-established for similar applications. In 1990, following regulatory approval from the Washington State Department of Ecology, a similar engineered cover with asphalt surfacing and an underlying geomembrane was installed for a site in Tacoma, Washington. Six months after installation, a rainstorm equivalent to a 100-year storm event occurred in the area. Monitoring of the subsurface showed that there was no leakage through the asphalt cover. Cores taken from the cover were measured to have permeabilities on the order of 10^{-9} cm/sec (Schlect, 1991). More recently, asphaltic concrete was chosen as the primary hydraulic barrier for the engineered cover at Operable Unit 4 at Rocky Flats Environmental Technology Site, near Denver, Colorado. Asphalt was chosen for this cover based primarily on its extremely low permeability and its durability for long time periods (Parsons ES, 1995b).

Design of an asphalt cover at the site would involve development of an appropriate mix specification that places an emphasis on low permeability, flexibility, and strength. Based on extensive research, it is well documented that mixes having higher asphalt contents (6 to 9 percent) and smaller-size aggregates are generally more flexible and have lower permeabilities than typical roadway paving mixes. Consideration would be given to these variables during design specification of the asphalt mix to be used for the cover. In addition, compaction control during placement can be used to positively impact the strength and permeability of the asphalt cover. An asphalt cement that is more applicable for hydraulic linings would be chosen over roadway asphalt cements based on the need for superior flexibility and resistance to weathering.

Because of the relatively small area that requires covering, installation of a standard RCRA cover is judged to be impractical. Startup efforts for installation of a RCRA cover would be significantly more intensive than for an asphalt cover. A borrow-source investigation and a laboratory testing program would be required to identify an adequate source of clay. There are no known sources local to the site that have a supply of acceptable clay for RCRA liner applications. Identification of an asphalt contractor who has access to acceptable materials and the appropriate level of experience and determination of a design mix for the asphalt concrete that meets appropriate requirements for strength and permeability are not expected to pose any difficulties. Typical requirements for installation of a RCRA cover include construction of a test pad to define adequate placement methods for the compacted clay portion of the cover. Assuming standard dimensions, the test pad would cover an area approximately one-tenth the size of the entire cover. QA testing during installation of a RCRA cover would require significantly greater time and expense than that for an asphalt cover. It is estimated that an asphalt cover would be installed in less than 50 percent of the time required for installation of a RCRA cover.

The design of the asphalt cover would include the requirement that the cover consist of a continuous pad without overlapping cold joints, which would minimize the amount of infiltration through the cover. Similar to the taxiway cover, a subsurface drainage system and secondary hydraulic barrier would be installed. These components of the proposed asphalt cover would ensure that surface water infiltration into contaminated subgrade soils at the HWSA would be minimal. Other benefits of the asphalt cover are similar to those described for the taxiway cover, including limited cut-and-fill activities, minimal to no offsite disposal requirements, and ease of construction.

In summary, installation and QA/QC efforts required for installation of a cover with a compacted clay component are significantly higher than for the proposed asphalt cover. As discussed above, use of an appropriate asphalt mix specification would allow construction of a durable cover with extremely low permeability. The asphalt cover would require traditional construction placement techniques and would include the traditional, well-established QA/QC methods commonly utilized in roadway construction. Maintenance of an asphalt cover would be relatively simple, with the primary activities consisting of periodic inspections and reapplications of the surface

seal coat. Because of the relatively small area that requires covering, the disadvantages involved with the installation of a standard RCRA cover at the site are judged to outweigh any limited benefits that a RCRA cover may have over a simple asphalt cover.

5.76.2.2 Cover Materials

The materials for the asphalt cover are the same as those for the taxiway cover with the exception of the surface layer, which would be asphalt instead of concrete. The asphalt would function as a hydraulic barrier, restricting infiltration from reaching the subsurface soils. The layers of the proposed asphalt cover are presented on Figure 5.10 and include the following:

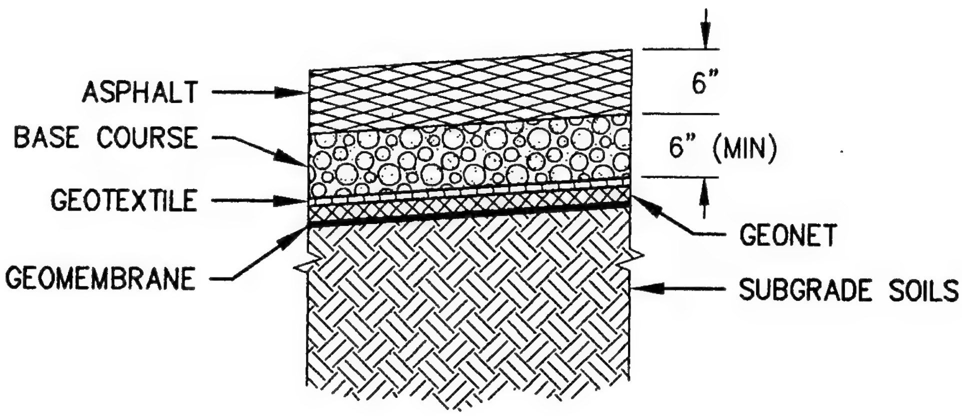
- Geomembrane (FML),
- Geonet (fabricated drainage net),
- Geotextile (filter fabric),
- Base course, and
- Asphalt (including seal coat).

This subsection discusses the layers of the asphalt cover. For each of the layers, a description of the materials to be used and the primary function of the layer is provided.

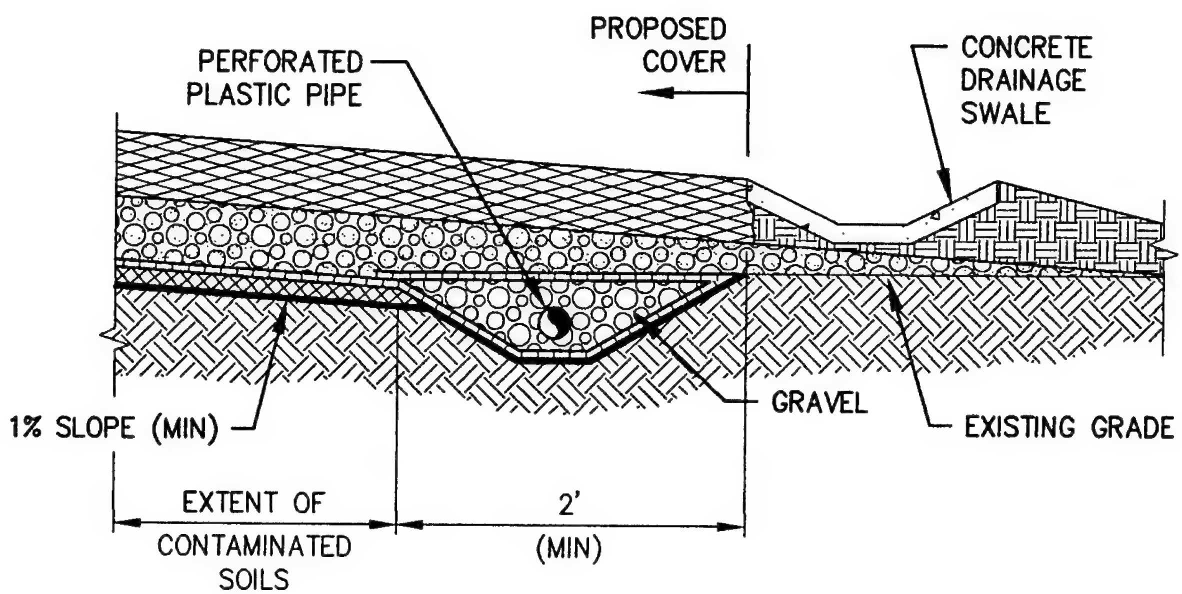
Prior to placement of the cover materials, the existing ground surface would be graded to a minimum slope of 1 percent and compacted. As described for the taxiway cover, the grading plan would be designed to minimize the amount of cut and fill required, attempting to use the existing ground contours to the maximum extent practical. The minimum 1-percent slope of the subgrade will be established to allow for adequate functioning of the subsurface drainage system. This slope may be modified on the basis of the required design capacity of the subsurface drain.

Geomembrane

A geomembrane (FML) would be placed immediately above the graded, compacted ground surface, and would function as a hydraulic barrier, restricting infiltration from reaching the underlying contaminated soils. As with the taxiway cover, the geomembrane will be specified to meet the Ohio EPA regulatory requirements for geosynthetic cover materials (i.e., 60-mil, linear-low-density polyethylene). In addition, the specifications for the geomembrane will be determined from the strength requirements for construction-related and long-term loading conditions. Neither chemical compatibility nor settlement-related stresses at the site are expected to impact the design life of the geomembrane.



TYPICAL SECTION
NOT TO SCALE



TOE DRAIN AND DRAINAGE SWALE DETAIL
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FIGURE 5.10

DETAILS OF CONTINGENCY ASPHALT COVER

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Geonet

As described for the taxiway cover, a geonet fabric would be placed above the geomembrane to provide a drainage layer that promotes lateral transport of water to the downgradient edges of the cover system. The geonet would be specified on the basis of the estimated infiltration rate through the asphalt and the slope of the graded surface on which the geomembrane and the overlying layers will be placed. Specification of the geonet also would consider the reduction in flow capacity attributable to vertical loading from the overlying cover materials.

Geotextile

A geotextile would be placed above the geonet and below the base course layer in order to prevent fine-grained soil particles from migrating into the geonet. This would prevent clogging of the geonet, allowing it to maintain functionality over the design lifetime of the cover. The combination of the geotextile and the geonet would serve as a protective layer for the geomembrane, which otherwise could be subject to potential puncturing from the overlying base course materials. The geotextile would be specified for the final design on the basis of the particle-size gradation of the overlying base course and the strength requirements dictated by construction-related and long-term loading conditions. Specification of the geotextile would ensure adequate permeability and soil-filtering characteristics.

Base Course

Immediately below the asphalt surfacing, a minimum of 6 inches of granular base course would be placed. This layer would provide a stable foundation for the asphalt concrete surface and would also act as a drain to move water away from the asphalt to minimize the potential for freeze-thaw effects. The base course materials for the asphalt cover would be similar those typically specified for highway base courses. The specifications for the base course would include requirements for particle-size gradation and aggregate durability.

Asphalt

The uppermost layer of the cover would consist of a minimum of 6 inches of roller-compacted asphalt. This layer would act as a hydraulic barrier, restricting precipitation infiltration from reaching the subsurface soils. The asphalt design mix would have a relatively high asphalt content and smaller aggregate sizes than typical roadway asphalt. The mix specification combined with proper placement would ensure that the asphalt cover has a permeability lower than the RCRA standard of 10^{-7} cm/sec for compacted clay covers. The mix specification also would account for the relevant requirements for strength and flexibility of the asphalt. Specifications for the cover installation would include the appropriate compaction methods and QA/QC requirements.

Following placement of the asphalt, a seal coat would be applied to the surface to minimize the effects of oxidation.

5.76.2.3 Cover Configuration

The asphalt cover would be situated in the same position as the taxiway cover and would be placed as one continuous pad with no construction joints. The proposed cover would extend a minimum of 2 feet beyond the existing fence which lines the perimeter of the affected area. The proposed cover would be approximately 100 feet by 170 feet (approximately 0.3 acre).

5.76.2.4 Subsurface Drainage Control

The subsurface drainage system for the asphalt cover would be the same as described for the taxiway cover.

5.76.2.5 Surface Water Control

The surface water control measures for the asphalt cover would include designing a cover grade to promote runoff, installation of drainage swales to collect the runoff and direct it to the nearest storm sewer, and construction of berms to limit runon from surrounding areas. The grading of the cover would follow the natural ground surface to the maximum extent practicable while still promoting runoff to the downgradient edges of the cover (i.e., the southeastern and northeastern edges). The minimum grade of the cover would be determined from design criteria for storm water flow events. This design storm event also would allow determination of design flow volumes to be used for drainage swale sizing around the cover and to offsite facilities.

Figure 5.10 presents the proposed configuration of a concrete-lined swale, and shows the conceptual tie-in to the cover system. Drainage swales would be constructed on the downgradient edges of the cover. Temporary berms upgradient from the affected area would be constructed as necessary to control runon to the site during construction. Details of the swale specifications and other surface water control measures would be finalized during the final design **of any contingency option**.

5.76.2.6 Installation Procedures

Installation of the asphalt cover would include installation of the subsurface drainage system and installation of the compacted base course foundation and asphalt surfacing. The procedures and equipment needed for site preparation and installation of the subsurface drainage system would be consistent with those described for the taxiway cover. Installation procedures for the base course foundation and the asphalt surfacing are described below.

Placement of the base course foundation for the asphalt cover would involve spreading and compaction with standard earthmoving and compaction equipment.

Because the base course would be placed directly on top of the geotextile layer, the design specifications would require that extreme care be taken not to damage the geotextile during placement and compaction. QA/QC during placement of the base course would ensure that a minimum 95 percent of the maximum dry density (per American Society for Testing and Materials D698) is achieved by compaction.

Placement of the asphalt surfacing would be performed using standard paving construction equipment and methods. QA/QC testing during placement would ensure that the minimum specified density for the asphalt is achieved. Following placement of the asphalt surfacing, a seal coat would be applied using standard methods for roadways.

SECTION 6

SAMPLING PLAN AND ANALYTICAL PROCEDURES

This sampling and analytical plan has been developed to establish a general protocol for compliance soil and quarterly groundwater sampling at the HWSA during the site closure and during post-closure monitoring. In addition, this plan outlines soil gas testing of both the soil remediation and groundwater oxygenation systems that will occur during site closure activities at the HWSA. Section 6.1 below describes the soil gas sampling that will be performed during the operation of the soil remediation and groundwater oxygenating systems sampling. Section 6.2 discusses compliance soil that will be performed after two years of operation of the soil remediation and groundwater oxygenation system to confirm soil contaminant loss. Section 6.3 discusses groundwater sample collection procedures that will be used in all quarterly sampling events. Section 6.4 outlines sampling handling procedures. ~~and~~ Section 6.5 discusses QA/QC sample collection **and potential interferences. Section 6.6 presents procedures for calibrating field equipment. Section 6.7 briefly describes a methodology for determining horizontal and vertical contaminant migration rates.**

All field sampling activities will be recorded in a bound, sequentially paginated field notebook in permanent ink. All sample collection entries will include the date, time, sample locations and numbers, notations of field observations, and the sampler's name and signature.

6.1 SOIL GAS SAMPLING

Soil gas will be used as an indicator of subsurface hydrocarbon contamination and to assess the effectiveness of *in situ* soil remediation (e.g., bioventing) and groundwater oxygenation (i.e., biosparging) operations in removing source contamination at the site. The use of soil gas to delineate potential subsurface contamination and to determine effectiveness of source reduction technologies has several economic and technical advantages over more traditional drilling and soil sampling techniques. The labor and equipment cost can be significantly less than a conventional drilling and sampling team. Many new hydraulically driven, multi-purpose probes can be used for soil gas sampling. These probes can be advanced as quickly as conventional augers and do not produce drill cuttings which can require expensive analysis and disposal. Further, soil gas sampling can represent the average chemistry of several cubic feet of soil as compared to a discrete soil sample, which can only describe a few cubic inches of the subsurface. This is of particular importance in risk-based remediation projects where

the extent of contamination and the degree of contaminant removal can most accurately be determined by using multiple soil gas sampling locations.

6.1.1 Soil Gas Sampling Frequency And Locations

The test equipment and methods that will be required to conduct field soil gas sampling as part of the closure activities at this site are described fully in *Addendum One To Test Plan And Technical Protocol For A Field Treatability Test For Bioventing - Using Soil Gas Surveys To Determine Bioventing Feasibility And Natural Attenuation Potential* (Downey and Hall, 1994). In summary, soil gas sampling will be conducted initially to establish a soil gas chemistry baseline prior to implementation of the soil remediation and groundwater oxygenation systems at the site. Field screening analytical samples will be collected **at least once**~~twice~~ per year during system operation to assess contaminant removal rates, radius of influence, and oxygenation of contaminated saturated and unsaturated soils. Soil gas sampling will be performed **at least annually**~~every 6 months~~ during operation of both systems to measure contaminant reduction, oxygen utilization, **and** biodegradation rates.

Once soil gas contaminant concentrations and respiration rates indicate contaminant mass loss via biodegradation, confirmatory soil and groundwater (part of the regularly planned quarterly groundwater monitoring schedule) samples will be collected to verify the effectiveness of the remediation systems. Proposed soil and groundwater remediation/**closure** actions are expected to significantly decrease contaminant mass in soil and groundwater underlying the HWSA in approximately 2 years. Results of soil gas sampling for both the soil remediation and groundwater oxygenation operations will be provided to Rickenbacker ANGB, AFCEE, and the Ohio EPA to update all parties involved in the ~~remediation~~**closure** process.

6.1.2 Soil Gas Sampling Procedures

Soil gas sampling will be conducted at several newly installed MPS (and groundwater monitoring, air sparging, and vent wells with unsaturated screen when possible). Gaseous concentrations of carbon dioxide (CO_2) and oxygen (O_2) will be measured in the field using an O_2/CO_2 analyzer. The analyzer will generally have an internal battery-powered sampling pump and range settings of 0 to 25 percent for both O_2 and CO_2. Before analyzing samples, the analyzer must be calibrated and the battery charge checked **in accordance with the manufacturer's instructions. Typically, t**~~T~~he analyzer will be calibrated daily using atmospheric conditions of O_2 (20.9 percent) AND CO_2 (0.05 percent) and a gas standard containing 0.0 percent O_2 and 5.0 percent CO_2. **Calibration of field equipment is discussed further in Section 6.6.**

Total volatile hydrocarbon (TVH) concentrations also will be measured at the HWSA. The TVH analyzer used at the site will be capable of measuring hydrocarbon concentrations in the range of 1 to 20,000 parts per million, volume per volume (ppmv). The analyzer is also capable of distinguishing between methane and non-

methane hydrocarbons. The TVH analyzer will be calibrated daily **in accordance with the manufacturer's instructions**~~using a 4,000 ppmv hexane calibration gas~~.

All soil gas samples taken during monitoring at the site will be collected using 3-liter Tedlar® bags and a vacuum chamber. The soil gas samples will be analyzed by attaching the O_2/CO_2 and TVH analyzers directly to the Tedlar® bag. Sample locations identified for analytical, compound-specific analysis will be re-sampled using 3-liter Tedlar® bags and a vacuum chamber. The samples will then be transferred to 1-liter SUMMA® canisters for compound-specific analysis by a fixed-base laboratory using U.S. Environmental Protection Agency (USEPA) Analytical Method TO-1**4**~~3~~. **The soil gas sample protocol for laboratory analysis and field-screening is presented in Tables 6.1 and 6.2, respectively. Practical quantitation limits (PQLs) for laboratory soil gas samples are presented in Table 6.3 and sample container, volume, preservation techniques, and holding times are shown in Table 6.4.**

Field quality assurance/quality control (QA/QC) procedures for soil gas will include collection of one field duplicate for every 10 samples collected (e.g., frequency of 10 percent), use of analyte-appropriate containers, and chain-of-custody procedures for sample handling and tracking. All samples to be transferred to the analytical laboratory for analysis will be clearly labeled to indicate sample number, location, matrix (e.g., soil gas), and analyses requested. Samples will be preserved in accordance with the analytical method to be used.

~~All field sampling activities will be recorded in a bound, sequentially paginated field notebook in permanent ink. All sample collection entries will include the date, time, sample locations and numbers, notations of field observations, and the sampler's name and signature.~~

The analytical laboratory will conduct one matrix spike analysis, one laboratory control sample, and one laboratory blank test for each specific analysis requested for soil gas (i.e., required only once for soil gas because only one analytical method will be used).

6.2 COMPLIANCE SOIL SAMPLING

Compliance soil sampling will be performed as part of the closure activities to ensure that soil remedial action has significantly reduced soil contaminant mass. A total of nine soil samples will be collected at the HWSA as part of the compliance sampling program. Eight samples will be collected from four boreholes within the soil treatment area and one QA/QC sample will be collected. The following sections describe borehole installation, soil sampling, procedures for equipment decontamination, and datum surveying procedures to be used as part of the soil sampling field effort. The analytical protocol for compliance soil samples is presented in Tables 6.1 **and 6.2. Requirements for soil sample containers, volumes, preservation, and holding times are presented in Table 6.4 and PQLs for soil sample analysis are presented in Table 6.5.**

TABLE 6.1
LABORATORY ANALYTICAL PROTOCOL FOR GROUNDWATER, SOIL, AND SOIL GAS SAMPLES
HAZARDOUS WASTE STORAGE AREA
AMMENDED CLOSURE/POST-CLOSURE PLAN
RICKENBACKER ANGB, OHIO

MATRIX/ANALYSIS	METHOD/REFERENCE
GROUNDWATER	
Sulfate	E300 or SW9056
Nitrate	E300 or SW9056
Nitrite	E300 or SW9056
Chloride	E300 or SW9056
Alkalinity	E310.1
Methane, Ethane, and Ethene	RSKSOP175, or SW3810, modified
Total Organic Carbon	EPA 415.1, or SW9060
Aromatic and Chlorinated Hydrocarbons (BTEX), Trimethylbenzene Isomers, Chlorinated Compounds	SW8260A
Semivolatile Organics	SW8270B
Total Volatile Petroleum Hydrocarbons	SW8015, modified (Gasoline)
SOIL	
Total Organic Carbon	SW9060
Moisture	EPA 160.3
Aromatic and Chlorinated Hydrocarbons (BTEX) Trimethylbenzene Isomers, Chlorinated Compounds	SW8260A
Semivolatile Organics	SW8270B
Total Volatile Hydrocarbons	SW8015, modified (Gasoline)
Biologically Available Iron (IIII)	Under development
SOIL GAS	
Fuel and Chlorinated VOCs	TO-14
FREE PRODUCT	
Aromatic Hydrocarbons	SW8020

TABLE 6.2
FIELD ANALYTICAL PROTOCOL FOR GROUNDWATER, SOIL, AND SOIL GAS SAMPLES
HAZARDOUS WASTE STORAGE AREA
AMENDED CLOSURE/POST-CLOSURE PLAN
RICKENBACKER ANGB, OHIO

MATRIX/ANALYSIS	METHOD/REFERENCE
GROUNDWATER	
Ferrous Iron (Fe+2)	Colorimetric, Hach Method 8146
Manganese	Colorimetric, Hach Method 8034
Sulfide	Colorimetric, Hach Method 8131
Nitrate	Titrimetric, Hach Method 8039 and 8192
Nitrite	Titrimetric, Hach Method 8040
Redox Potential	A2580B, direct reading meter
Oxygen	Direct reading meter
pH	SW9040/9045, direct reading meter
Conductivity	SW9050, direct reading meter
Temperature	Direct reading meter
Alkalinity (Carbonate [CO3-2]	Titrimetric, Hach Method 8221
and Bicarbonate [HCO3-1])	
Carbon Dioxide	CHEMetrics Method 4500
Chloride	Hach Model 8P
Ammonia--Diss. Gas in Water	CHEMetrics Method 4500
SOIL	
Total Organic Vapors	Headspace with direct reading meter
SOIL GAS	
Total Volatile Hydrocarbons	GasTech analyzer, or equivalent
Oxygen, Carbon Dioxide	GasTech analyzer, or equivalent

TABLE 6.3
PRACTICAL QUANTITATION LIMITS FOR SOIL GAS
HAZARDOUS WASTE STORAGE AREA
AMENDED CLOSURE/POST-CLOSURE PLAN
RICKENBACKER ANGB, OHIO

Parameter/Method	Analyte	Soil Gas PQL[a/] (ppbv[b/])
Volatile Organics	1,1,1-Trichloroethane	0.5
TO-14	1,1,2,2-Tetrachloroethane	0.5
	1,1,2-Trichloroethane	0.5
	1,1-Dichloroethane	0.5
	1,1-Dichloroethene	0.5
	1,2,4-Trimethylbenzene	0.5
	1,3-Butadiene	2.0
	2-Butanone (MEK)	2.0
	2-Hexanone	2.0
	2-Propanol	2.0
	1,2-Dichloroethane	0.5
	1,2-Dichlorobenzene	0.5
	1,2-Dichloropropane	0.5
	1,3,5-Trimethylbenzene	0.5
	1,3-Dichlorobenzene	0.5
	1,4-Dichlorobenzene	0.5
	Chlorotoluene	0.5
	4-Ethyltoluene	2.0
	4-Methyl-2-pentanone	2.0
	Acetone	2.0
	Benzene	0.5
	Bromodichloromethane	2.0
	Bromoform	2.0
	Bromomethane	0.5
	Carbon Disulfide	2.0
	Carbon Tetrachloride	0.5
	Chlorobenzene	0.5
	Chloroethane	0.5
	Chloroform	0.5
	Chloromethane	0.5
	Chloroprene	2.0
	Cis-1,2-Dichloroethene	0.5
	Cis-1,3-Dichloropropene	0.5
	Cyclohexane	2.0

TABLE 6.3 (Continued)
PRACTICAL QUANTITATION LIMITS FOR SOIL GAS
HAZARDOUS WASTE STORAGE AREA
AMENDED CLOSURE/POST-CLOSURE PLAN
RICKENBACKER ANGB, OHIO

Parameter/Method	Analyte	Soil Gas PQL[a] (ppbv [b])
Volatile Organics	Dibromochloromethane	2.0
TO-14 (Cont)	Ethanol	2.0
	Ethylbenzene	0.5
	Ethylene Dibromide	0.5
	Freon 11	0.5
	Freon 12	0.5
	Freon 114	0.5
	Heptane	2.0
	Hexachlorobutadiene	0.5
	Hexane	2.0
	m,p-Xylene	0.5
	Methyl t-Butyl Ether (MTBE)	2.0
	Methylene Chloride	0.5
	Propylene	2.0
	o-Xylene	0.5
	Styrene	0.5
	Tetrachloroethene	0.5
	Tetrahydrofuran	2.0
	Tricholoroethene	0.5
	Toluene	0.5
	Trans-1,2-Dichloroethene	2.0
	Trans-1,3-Dichloropropene	0.5
	Vinyl Acetate	2.0
	Vinyl Chloride	0.5

SOURCE: Air Toxics Ltd., Folsom, California.

[a] PQLs = practical quantitation limits. PQLs are equal to the laboratory reporting limits.
[b] ppbv = parts per billion, volume per volume.

TABLE 6.4
REQUIREMENTS FOR CONTAINERS, PRESERVATION TECHNIQUES, SAMPLE VOLUMES, AND HOLDING TIMES
HAZARDOUS WASTE STORAGE AREA
AMENDED CLOSURE/POST-CLOSURE PLAN
RICKENBACKER ANGB, OHIO

Parameter	Analytical Methods	Container[a]	Preservation[b/c]	Minimum Sample Volume or Weight	Maximum Holding Time
Alkalinity	E310.1	P, G	4°C[d]	50 mL[e]	14 days
Common Anions	SW9056	P, G	None required	50 mL	28 days for Cl^{-}[f] and SO_4^{-2}[g]; 48 hours for NO_3^{-}[h] and NO_2^{-}[i]
Methane, Ethane, and Ethene	SW3810, modified	G, Teflon-lined cap	4°C	3 x 40 mL	14 days
Total Organic Carbon	SW9060, modified	G, wide mouth	4°C	200 mL	28 days
Aromatic and Chlorinated Hydrocarbons	SW8260A	G, Teflon-lined septum, T	4°C, 0.008% $Na_2S_2O_3$[j] (HCl[k] to pH < 2 for volatile aromatics by SW8240 and SW8260)	2 x 40 mL or 4 ounces	14 days (water and soil); 7 days if unpreserved by acid
Semivolatile Organics including PAHs	SW8270B	G, Teflon-lined cap, T	4°C, 0.008% $Na_2S_2O_3$	1 liter or 8 ounces	7 days until extraction and 40 days after extraction (water); 14 days until extraction and 40 days after extraction (soil)
Total Volatile Petroleum Hydrocarbons	SW8015, modified (Gasoline)	G, Teflon-lined Septum, T	4°C	2 x 40 mL or 4 ounces	14 days
Conductance	SW9050	P,G	None required	NA[l]	Analyze immediately
Volatile Organics	TO-14	Summa	None required	1-liter	14 days

a/ Polyethylene (P); glass (G); brass sleeves in the sample barrel, sometimes called California brass (T).
b/ No pH adjustment for soil.
c/ Preservation with 0.008 percent $Na_2S_2O_3$ is only required when residual chlorine is present.
d/ °C = Degrees Celsius
e/ mL = Milliliter
f/ Cl = Chloride
g/ SO_4 = Sulfate
h/ NO_3 = Nitrate
i/ NO_2 = Nitrite
j/ $Na_2S_2O_3$ = Sodium thiosulfate
k/ HCl = Hydrochloric acid
l/ NA = Not applicable

TABLE 6.5
PRACTICAL QUANTITATION LIMITS FOR SOIL AND GROUNDWATER
HAZARDOUS WASTE STORAGE AREA
AMENDED CLOSURE/POST-CLOSURE PLAN
RICKENBACKER ANGB, OHIO

Parameter/Method	Analyte	Water		Soil	
		PQL[a]	Unit	PQL	Unit
Volatile Organics	1,1,1,2-Tetrachloroethane	0.5	μg/L[b]	0.003	mg/kg[c]
SW5030A/SW8260A	1,1,1-Trichloroethane	0.8	μg/L	0.004	mg/kg
(W[d], S[e])	1,1,2,2-Tetrachloroethane	0.4	μg/L	0.002	mg/kg
	1,1,2-Trichloroethane	1.0	μg/L	0.005	mg/kg
	1,1-Dichloroethane	0.4	μg/L	0.002	mg/kg
	1,1-Dichloroethene	1.2	μg/L	0.006	mg/kg
	1,1-Dichloropropene	1.0	μg/L	0.005	mg/kg
	1,2,3-Trichlorobenzene	0.3	μg/L	0.002	mg/kg
	1,2,3-Trichloropropane	3.2	μg/L	0.02	mg/kg
	1,2,4-Trichlorobenzene	0.4	μg/L	0.002	mg/kg
	1,2,4-Trimethylbenzene	1.3	μg/L	0.007	mg/kg
	1,2-Dichloroethane	0.6	μg/L	0.003	mg/kg
	1,2-Dichlorobenzene	0.3	μg/L	0.002	mg/kg
	1,2-Dibromo-3-Chloropropane	2.6	μg/L	0.01	mg/kg
	1,2-Dichloropropane	0.4	μg/L	0.002	mg/kg
	1,2-Dibromoethane	0.6	μg/L	0.003	mg/kg
	1,3,5-Trimethylbenzene	0.5	μg/L	0.003	mg/kg
	1,3-Dichlorobenzene	1.2	μg/L	0.006	mg/kg
	1,3-Dichloropropane	0.4	μg/L	0.002	mg/kg
	1,4-Dichlorobenzene	0.3	μg/L	0.002	mg/kg
	1-Chlorohexane	0.5	μg/L	0.003	mg/kg
	2,2-Dichloropropane	3.5	μg/L	0.02	mg/kg
	2-Chlorotoluene	0.4	μg/L	0.002	mg/kg
	4-Chlorotoluene	0.6	μg/L	0.003	mg/kg
	Benzene	0.4	μg/L	0.002	mg/kg
	Bromobenzene	0.3	μg/L	0.002	mg/kg
	Bromochloromethane	0.4	μg/L	0.002	mg/kg
	Bromodichloromethane	0.8	μg/L	0.004	mg/kg
	Bromoform	1.2	μg/L	0.006	mg/kg

TABLE 6.5 (Continued)
PRACTICAL QUANTITATION LIMITS FOR SOIL AND GROUNDWATER
HAZARDOUS WASTE STORAGE AREA
AMENDED CLOSURE/POST-CLOSURE PLAN
RICKENBACKER ANGB, OHIO

Parameter/Method	Analyte	Water		Soil	
		PQL[a]	Unit	PQL	Unit
Volatile Organics (Cont)	Bromomethane	1.1	µg/L	0.005	mg/kg
SW5030A/SW8260A	Carbon Tetrachloride	2.1	µg/L	0.01	mg/kg
(W, S)	Chlorobenzene	0.4	µg/L	0.002	mg/kg
	Chloroethane	1.0	µg/L	0.005	mg/kg
	Chloroform	0.3	µg/L	0.002	mg/kg
	Chloromethane	1.3	µg/L	0.007	mg/kg
	Cis-1,2-Dichloroethene	1.2	µg/L	0.006	mg/kg
	Cis-1,3-Dichloropropene	1.0	µg/L	0.005	mg/kg
	Dibromochloromethane	0.5	µg/L	0.003	mg/kg
	Dibromomethane	2.4	µg/L	0.01	mg/kg
	Dichlorodifluoromethane	1.0	µg/L	0.005	mg/kg
	Ethylbenzene	0.6	µg/L	0.003	mg/kg
	Hexachlorobutadiene	1.1	µg/L	0.005	mg/kg
	Isopropylbenzene	0.5	µg/L	0.008	mg/kg
	m-Xylene	0.5	µg/L	0.003	mg/kg
	Methylene Chloride	0.3	µg/L	0.002	mg/kg
	n-Butylbenzene	1.1	µg/L	0.005	mg/kg
	n-Propylbenzene	0.4	µg/L	0.002	mg/kg
	Naphthalene	0.4	µg/L	0.002	mg/kg
	o-Xylene	1.1	µg/L	0.005	mg/kg
	p-Isopropyltoluene	1.2	µg/L	0.006	mg/kg
	p-Xylene	1.3	µg/L	0.007	mg/kg
	Sec-Butylbenzene	1.3	µg/L	0.007	mg/kg
	Styrene	0.4	µg/L	0.002	mg/kg
	Tricholoroethene	1.0	µg/L	0.01	mg/kg
	Tert-Butylbenzene	1.4	µg/L	0.007	mg/kg
	Tetrachloroethylene	1.4	µg/L	0.007	mg/kg
	Toluene	1.1	µg/L	0.005	mg/kg
	Trans-1,2-Dichloroethene	0.6	µg/L	0.003	mg/kg
	Trans-1,3-Dichloropropene	1.0	µg/L	0.005	mg/kg
	Trichlorofluoromethane	0.8	µg/L	0.004	mg/kg

TABLE 6.5 (Continued)
PRACTICAL QUANTITATION LIMITS FOR
SOIL AND GROUNDWATER
HAZARDOUS WASTE STORAGE AREA
AMENDED CLOSURE/POST-CLOSURE PLAN
RICKENBACKER ANGB, OHIO

		Water		Soil	
Parameter/Method	**Analyte**	**PQL[a/]**	**Unit**	**PQL**	**Unit**
Semivolatile Organics	1,2,4-Trichlorobenzene	10.0	µg/L	0.7	mg/kg
Base/Neutral Extractables	1,2-Dichlorobenzene	10.0	µg/L	0.7	mg/kg
SW3510B/SW8270B (W)	1,3-Dichlorobenzene	10.0	µg/L	0.7	mg/kg
SW3550A/SW8270B (S)	1,4-Dichlorobenzene	10.0	µg/L	0.7	mg/kg
	2,4-Dinitrotoluene	10.0	µg/L	0.7	mg/kg
	2,6-Dinitrotoluene	10.0	µg/L	0.7	mg/kg
	2-Chloronaphthalene	10.0	µg/L	0.7	mg/kg
	2-Methylnaphthalene	10.0	µg/L	0.7	mg/kg
	2-Nitroaniline	50.0	µg/L	3.3	mg/kg
	3-Nitroaniline	50.0	µg/L	3.3	mg/kg
	3.3'-Dichlorobenzidine	20.0	µg/L	1.3	mg/kg
	4-Bromophenyl Phenyl Ether	10.0	µg/L	0.7	mg/kg
	4-Chloroaniline	20.0	µg/L	1.3	mg/kg
	4-Chlorophenyl Phenyl Ether	10.0	µg/L	0.7	mg/kg
	4-Nitroaniline	50.0	µg/L	3.3	mg/kg
	Acenaphthylene	10.0	µg/L	0.7	mg/kg
	Acenapthene	10.0	µg/L	0.7	mg/kg
	Anthracene	10.0	µg/L	0.7	mg/kg
	Benz (a) Anthracene	10.0	µg/L	0.7	mg/kg
	Benzo (a) Pyrene	10.0	µg/L	0.7	mg/kg
	Benzo (b) Fluoranthene	10.0	µg/L	0.7	mg/kg
	Benzo (g,h,i) Perylene	10.0	µg/L	0.7	mg/kg
	Benzyl Alcohol	20.0	µg/L	1.3	mg/kg
	Bis (2-Chlorethyl) Ether	10.0	µg/L	0.7	mg/kg
	Bis (2-Chloroethoxy) Methane	10.0	µg/L	0.7	mg/kg
	Bis (2-Chloroisopropyl) Ether	10.0	µg/L	0.7	mg/kg
	Bis (2-Ethylhexyl) Phthalate	10.0	µg/L	0.7	mg/kg
	Butyl Benzylphthalate	10.0	µg/L	0.7	mg/kg

TABLE 6.5 (Continued)
PRACTICAL QUANTITATION LIMITS FOR SOIL AND GROUNDWATER
HAZARDOUS WASTE STORAGE AREA
AMENDED CLOSURE/POST-CLOSURE PLAN
RICKENBACKER ANGB, OHIO

Semivolatile Organics	Chrysene	10.0	µg/L	0.7	mg/kg
Base/Neutral Extractables	Di-n-Butylphthalate	10.0	µg/L	0.7	mg/kg
SW3510B/SW8270B (W)	Di-n-Octylphthalate	10.0	µg/L	0.7	mg/kg
SW3550A/SW8270B (S)	Dibenz (a,h) Anthracene	10.0	µg/L	0.7	mg/kg
(Cont)	Dibenzofuran	10.0	µg/L	0.7	mg/kg
	Diethyl Phthalate	10.0	µg/L	0.7	mg/kg
	Dimethly Phthalate	10.0	µg/L	0.7	mg/kg
	Fluoranthene	10.0	µg/L	0.7	mg/kg
	Fluorene	10.0	µg/L	0.7	mg/kg
	Hexachlorobenzene	10.0	µg/L	0.7	mg/kg
	Hexachlorobutadiene	10.0	µg/L	0.7	mg/kg
	Hexachlorocyclopentadiene	10.0	µg/L	0.7	mg/kg
	Hexachloroethane	10.0	µg/L	0.7	mg/kg
	Indeno (1,2,3-cd) Pyrene	10.0	µg/L	0.7	mg/kg
	Isophorone	10.0	µg/L	0.7	mg/kg
	n-Nitrosodiphenylamine	10.0	µg/L	0.7	mg/kg
	n-Nitrosodi-n-Propylamine	10.0	µg/L	0.7	mg/kg
	Naphthalene	10.0	µg/L	0.7	mg/kg
	Nitrobenzene	10.0	µg/L	0.7	mg/kg
	Phenanthrene	10.0	µg/L	0.7	mg/kg
	Pyrene	10.0	µg/L	0.7	mg/kg
Semivolatile Organics	2,4,5-Trichlorophenol	50.0	µg/L	3.3	mg/kg
Acid Extractables	2,4,6-Trichlorophenol	10.0	µg/L	0.3	mg/kg
SW3510B/SW8270B (W)	2,4-Dichlorophenol	10.0	µg/L	0.3	mg/kg
SW3550A/SW8270B (S)	2,4-Dimethylphenol	10.0	µg/L	0.3	mg/kg
	2,4-Dinitrophenol	50.0	µg/L	3.3	mg/kg
	2-Chlorophenol	10.0	µg/L	0.3	mg/kg
	2-Methylphenol	10.0	µg/L	0.3	mg/kg
	2-Nitrophenol	10.0	µg/L	0.3	mg/kg

TABLE 6.5 (Continued)
PRACTICAL QUANTITATION LIMITS FOR SOIL AND GROUNDWATER
HAZARDOUS WASTE STORAGE AREA
AMENDED CLOSURE/POST-CLOSURE PLAN
RICKENBACKER ANGB, OHIO

Parameter/Method	Analyte	Water		Soil	
		PQL[a]	Unit	PQL	Unit
Semivolatile Organics	4,6-Dinitro-2-Methylphenol	50.0	µg/L	3.3	mg/kg
Acid Extractables	4-Chloro-3-Methylphenol	20.0	µg/L	1.3	mg/kg
SW3510B/SW8270B (W)	4-Methylphenol	10.0	µg/L	0.3	mg/kg
SW3550A/SW8270B (S)	4-Nitrophenol	50.0	µg/L	1.6	mg/kg
(Cont)	Benzoic Acid	50.0	µg/L	1.6	mg/kg
	Pentachlorophenol	50.0	µg/L	3.3	mg/kg
	Phenol	10.0	µg/L	0.3	mg/kg
	Vinyl Chloride	1.1	µg/L	0.009	mg/kg
Gasoline Range Organics SW8015 Modified (W)	Total Volatile Petroleum Hydrocarbons	100	µg/L	1.0	mg/kg
Methane	Methane	2.0	µg/L	NA[f]	NA
SW3810 Modified	Ethane	4.0	µg/L	NA	NA
(W)	Ethene	2.0	µg/L	NA	NA
Common Anions	Chloride	0.2	mg/L[g]	0.2	mg/kg
SW9056	Nitrate	0.1	mg/L	0.1	mg/kg
	Nitrite	0.4	mg/L	0.1	mg/kg
	Sulfate	0.2	mg/L	0.2	mg/kg
E310.1	Alkalinity	10.0	mg/L	NA	NA
E353.1	Nitrogen, Nitrate/Nitrite	0.1	mg/L	NA	NA
SW9060	Total Organic Carbon	1.0	mg/L	10.0	mg/kg

SOURCE: AFCEE QAPP, Version 1.1, February 1996

[a] PQLs = practical quantitation limits. PQLs are equal to the project reporting limits.
[b] µg/L = micrograms per liter.
[c] mg/kg = milligrams per kilogram.
[d] W = water.
[e] S = soil.
[f] NA = not applicable.
[g] mg/L = milligrams per liter.

6.2.1 Sampling Locations

A total of four sampling locations will be used during the compliance sampling event at the HWSA site. One borehole will be placed adjacent to both of the proposed vertical vent wells, and one borehole will be placed approximately 50 feet downgradient of each vent well. The exact locations of the boreholes will be determined in the field based on the location of underground utilities and other potential interferences. Two samples will be collected from each borehole, one above the groundwater level and one below, for a total of eight samples. One QA/QC field replicate also will be collected from one of the boreholes.

6.2.2 Borehole Installation Procedures

Soil sampling in unconsolidated soils will be accomplished using a Geoprobe® hydraulic sampling rig or a similar sampling rig. The Geoprobe®, or similar rig, will be used to advance a sampler containing a butylene liner to the desired sampling depth. Once the desired sampling depth is attained, the end point of the sampler will be retracted and the sampler will be filled with soil. Following retrieval of the sampler, the liner will be removed, and its ends capped with Teflon® squares and plastic caps. All sampling equipment will be decontaminated prior to use and between uses, as described in Section 6.2.5. If subsurface conditions are such that the planned installation technique does not produce acceptable results another technique deemed more appropriate to the type of soils present will be used. Any alternate soil sampling procedure used must be approved by the field hydrogeologist and will be appropriate for the subsurface lithologies present at the site.

The field hydrogeologist will be responsible for observing all borehole installation and sampling activities, maintaining a detailed log of the target sample interval, photographing representative samples, and properly labeling and storing samples. An example of the proposed geologic boring log form is presented in Figure 6.1. The descriptive log will contain:

- Sample interval (top and bottom depth);
- Sample recovery;
- Presence or absence of contamination (e.g., staining, odor or elevated headspace screening readings);
- Soil or rock description of the target sampling interval, including relative density, color, major textural constituents, minor constituents, porosity, relative moisture content, plasticity of fines, cohesiveness, grain size, structure or stratification, relative permeability, and any other significant observations; and
- The depth of lithologic contacts and/or significant textural changes, measured and recorded to the nearest 0.1 foot (1 inch) if present within the target interval.

GEOLOGIC BORING LOG

BORING NO.: ______ CONTRACTOR: ______ DATE SPUD: ______
CLIENT: ______ RIG TYPE: ______ DATE CMPL.: ______
JOB NO.: ______ DRLG METHOD: ______ ELEVATION: ______
LOCATION: ______ BORING DIA.: ______ TEMP: ______
GEOLOGIST: ______ DRLG FLUID: ______ WEATHER: ______
COMENTS: ______

Elev (ft)	Depth (ft)	Pro- file	US CS	Geologic Description	Sample No.	Sample Depth (ft)	Sample Type	Penet Res	PID(ppm)	TLV(ppm)	TOTAL BTEX(ppm)	TPH (ppm)
	1											
	5											
	10											
	15											
	20											
	25											
	30											
	35											

NOTES
- bgs – Below Ground Surface
- GS – Ground Surface
- TOC – Top of Casing
- NS – Not Sampled
- SAA – Same As Above

SAMPLE TYPE
- D – DRIVE
- C – CORE
- G – GRAB

Water level drilled

FIGURE 6.1

GEOLOGIC BORING LOG

HWSA
Amended Closure/Post-Closure Plan
Rickenbacker ANGB, Ohio

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

6.2.3 Sampling Records

In order to provide complete documentation of the sampling event, detailed records will be maintained by the field hydrogeologist. At a minimum, these records will include the following information:

- Sample location (facility name);
- Sample identification;
- Sample location map or detailed sketch;
- Date and time of sampling;
- Sampling method;
- Field observations of
  - Sample appearance,
  - Sample odor;
- Weather conditions;
- Sampler's Identification;
- Any other relevant information.

6.2.4 Management Of Excavated Soils And Soil Cuttings

All excavated soil will be stored in roll-off boxes. Material will be separated on the basis of visual field screening and inspection, with material that appears to be clean placed in one box and material that appears to be contaminated placed in another. Material in the boxes will be sampled as they are filled, with at least three samples per roll-off; one from the bottom third, one from the middle third, and one from the top third. Additional samples will be taken if there is a visible change in the soil type or degree of contamination. Samples from each roll-off will be composited for laboratory analysis. Samples will be taken following the procedures outlined below, screened in the field for VOCs, and analyzed in a laboratory for the compounds associated with the HWSA (Table 6.1). Samples also will be analyzed for characteristics of hazardous waste (OAC 3745-51-20 through 24). Analytical results will be used to determine appropriate disposal for the soil.

Soil sampling of excavated soils and soil cuttings will proceed in accordance with ~~O~~ **Ohio** EPA and RCRA regulations~~ and the requirements of the Ohio Department of Commerce, Division of State Fire Marshal, Bureau of Underground Storage Tank Regulation (BUSTR)~~.

Each soil sample will be collected with a stainless steel trowel and evenly divided between two clean glass jars. One jar, intended for laboratory analysis, will be sealed with a Teflon®-lined lid. These samples will be packed in a cooler with ice and transported to the laboratory under the chain-of-custody procedures described in Section 6.3.

The second of the two jars will not be sent to the laboratory, but will be screened in the field for the presence of organic vapors. This jar will be sealed with aluminum foil and allowed to equilibrate for at least five minutes. The concentration of organic vapors in the headspace of the jar will then be tested using a photoionization detector (PID). If the air temperature is below 40°F, these samples will be set aside in a heated room and checked for vapors using the PID after they have warmed. **The PID will be calibrated daily in accordance with the manufacturer's instructions.**

6.2.5 Equipment Decontamination Procedures

Water to be used in equipment cleaning will be obtained from one of the base's onsite water supplies. Rickenbacker ANBG personnel will assist field personnel in locating a suitable source. Water use approval will be verified by contacting the appropriate facility personnel. Only potable water will be used for decontamination. A decontamination water blank will be collected from the potable water source. The field hydrogeologist will make the final determination as to the suitability of site water for these activities.

Prior to arriving at the site, and between each borehole installation, the Geoprobe® rods, samplers, tools and other downhole equipment will be decontaminated using a hot-water wash. During borehole installation operations, the rig, samplers, and any other downhole equipment will be decontaminated at **a temporary**~~the~~ decontamination pad~~ that is adjacent to Building 560.~~ **constructed prior to soil sampling. Wastewater generated during equipment decontamination will be disposed of in accordance with applicable regulations.**

All sampling tools will be cleaned with a clean water/phosphate-free detergent mix, a clean water rinse, isopropyl alcohol rinse, and a final distilled water rinse. Materials that cannot be cleaned to the satisfaction of the field scientist will not be used. All decontamination activities will be conducted in a manner so that the excess water will be controlled and not allowed to flow into any open borehole.

Fuel, lubricants, and other similar substances will be handled in a manner consistent with accepted safety procedures and standard operating practices. The Geoprobe® Rig will not be allowed onsite unless it is free from leaks in all hydraulic and fuel lines, and is free of any exterior oil and grease.

Surface runoff such as miscellaneous spills and leaks, precipitation, and spilled decontamination fluids will not be allowed to enter any boring. Berms around the

borehole and surficial bentonite packs, as appropriate, will be used to prevent cross-contamination.

Water used to decontaminate sampling equipment will be stored at the site in a tank appropriate for this use. When all decontamination water has been collected, or when the tank is full, a composite sample will be taken from the tank by collecting samples at 1-foot horizontal intervals. The samples will be analyzed to determine whether it can be discharged to the Columbus Sewer District system or must be transported off-site for treatment at a facility permitted to treat the constituents found. The analyses performed will be determined by the requirements of the Columbus Sewer District or the off-site treatment facility and by the constituents expected in the used decontamination water.

6.2.6 Survey Of Borehole Locations

The horizontal location of the new boreholes will be located by field personnel after completion of sampling procedures. Horizontal locations will be measured relative to previously installed groundwater wells that have established coordinates (i.e., previously surveyed by a registered surveyor). Horizontal distances will be recorded to the nearest 0.1 foot by measuring the distance from each borehole to three established locations (monitoring wells or other previously surveyed locations deemed more appropriate by field personnel). These distances will be used to locate each borehole on any additional maps generated as part of the risk-based investigation.

6.2.7 Borehole Abandonment

Geoprobe® sampling operations will produce boreholes that are approximately 2.5 inches in diameter. These holes will be abandoned by filling with pelletized bentonite. The bentonite will be hydrated in place with potable water at 2-foot intervals to ensure proper hydration and subsequent sealing of the borehole. The concrete at the site will be patched with ready-mix concrete troweled to match the existing **surface elevations**.

6.3 GROUNDWATER SAMPLING

The following sections describe the scope of work required for collecting quarterly groundwater samples~~ from the 27 monitoring wells in the long term monitoring well/ point network (Figure 9.1)~~ **during closure and post-closure activities. During closure activities, quarterly groundwater samples will be performed at the 19 monitoring wells shown in relief on Figure 4.1. Following the installation of 8 additional monitoring wells (Section 9.4.1), one assessment sampling event will be performed at these 27 monitoring wells. Subsequent to closure (i.e., during post-closure monitoring), quarterly sampling will be performed at a total of 12 monitoring wells (Figure 9.1).** All water samples collected from groundwater monitoring wells/ points will be obtained using a thoroughly decontaminated peristaltic pump and dedicated tubing.

Groundwater sampling will be conducted by qualified scientists and technicians trained in the conduct of well sampling, records documentation, and chain-of-custody procedures. Detailed groundwater sampling and sample handling procedures are presented in following sections.

Groundwater laboratory and field analytical protocols are shown in Tables 6.1 and 6.2, respectively. Requirements for sample containers, volumes, holding times, and preservation techniques are shown in Table 6.4 and PQLs for groundwater analysis are presented in Table 6.5.

6.3.1 Preparation For Sampling

All equipment to be used for sampling will be assembled and properly cleaned prior to the beginning of all sampling events. As required, field analytical equipment will be calibrated according to the manufacturer's specifications prior to field use. This applies to equipment used for onsite chemical measurements such as pH, electrical conductivity, and temperature.

In addition, all record keeping materials will be gathered prior to leaving the office. A brief organizational meeting will be held to ensure proper communication between project management staff and field personnel.

6.3.2 Equipment Decontamination

All portions of sampling and test equipment that will contact the sample will be thoroughly cleaned before each use. This equipment may include water-level probe and cable, oil/water interface probe and cable, test equipment for onsite use, and other equipment or portions thereof that will contact the samples. Based on the chemical constituents present at the mogas site, the following decontamination protocol will be used:

- Clean with potable water and phosphate-free laboratory detergent (Liquinox® or equivalent);
- Rinse with potable water;
- Rinse with distilled or deionized water;
- Rinse with reagent-grade isopropanol;
- Rinse with distilled or deionized water; and
- Air dry the equipment prior to use.

Water used to decontaminate sampling equipment will be stored at the site in a tank appropriate for this use. When all decontamination water has been collected, or when the tank is full, a composite sample will be taken from the tank by collecting samples at

1-foot horizontal intervals. The samples will be analyzed to determine whether it can be discharged to the Columbus sewer district system or must be transported off-site for treatment at a facility permitted to treat the constituents found. The analyses performed will be determined by the requirements of the Columbus sewer district or the off-site treatment facility and by the constituents expected in the used decontamination water.

Any deviations from these procedures will be documented in the field scientist's field notebook and on the groundwater sampling form. If pre-cleaned dedicated sampling equipment is used, the decontamination protocol specified above will not be required. Laboratory-supplied sample containers will be cleaned and sealed by the laboratory and therefore will not need to be cleaned in the field. Equipment field blanks and equipment rinseate samples will be collected to assure that all containers and field equipment are free of contamination.

6.3.3 Sampling Procedures

Special care will be taken to prevent contamination of the groundwater and extracted samples. The two primary ways in which sample contamination can occur are through contact with improperly cleaned equipment and by cross-contamination through insufficient decontamination of equipment between wells/points. To prevent such contamination, the peristaltic pump and water level probe and cable used to determine static water levels and total well depth will be thoroughly cleaned before and after field use and between uses at different sampling locations according to the procedures presented in Section 6.3.2. In addition to the use of properly cleaned equipment, a clean pair of new, disposable nitrile gloves will be worn each time a different well or station is sampled. New, clean tubing will be used for the peristaltic pump for each well sampled. Wells will be sampled sequentially from areas suspected to be least contaminated to areas suspected to be more contaminated. Plastic will be placed around each of the wells to be sampled and sampling equipment will not be allowed to come in contact with the ground surface at any time during the sampling event.

The following sections describe activities that comprise groundwater sample acquisition, and will be performed in the order as presented below. Exceptions to this procedure will be noted in the field scientist's field notebook.

6.3.4 Preparation Of Location

Prior to starting the sampling procedure, the area around the well or sampling location will be cleared of foreign materials, such as brush, rocks, and debris. These procedures will prevent sampling equipment from inadvertently contacting debris around the monitoring well. New, clean plastic (4 to 6 mil) we be placed around the well to prevent the contamination of both the ground surface and any equipment that may come into contact with the ground surface. In addition, the well/point will be inspected for integrity, including the protective cover, lock, external surface seal, pad, stick-up, well cap, datum reference, internal surface seal, and any dedicated equipment.

6.3.5 Water Level/~~and~~ Total Depth Measurements and Detection of Immiscible Liquids

Prior to removing any water from the well, the static water level will be measured. **Where possible, an oil/water interface**~~An electrical water level~~ probe will be used to measure the depth to groundwater below the datum to the nearest 0.01 foot. If the total depth of the well is not known or is suspected to be inaccurate, total well depth will be measured by slowly lowering the water level probe to the bottom of the well. Total well depth will be measured to the nearest 0.01 foot. **If an immiscible liquid (most likely a light nonaqueous phase liquid [LNAPL]) is encountered during water level measurement, LNAPL thickness also will be measured. Based on water level and total depth information, the volume of water to be purged from the well can be calculated.**- Total depth will only be measured when absolutely necessary to minimize the amount of sediment disturbance in the well. **If LNAPL is present in site monitoring wells, total well depth will not be measured.**~~Based on water level and total depth information, the volume of water to be purged from the well can be calculated.~~

Some of the monitoring wells/monitoring points located at the HWSA are too narrow for using the oil/water interface probe for determining the presence of immiscible liquids. For these wells/points, detection of immiscible liquids (LNAPLs) will be possible during purging using a peristaltic pump. Initial purging at these wells/points will be performed at the air/water interface in order to detect floating immiscible liquids.

6.3.6 Groundwater Monitoring Well/ Point Purging

The static groundwater inside each well will be purged using a peristaltic pump. The well will be purged at a very low flow rate [10 milliliters per minute (ml/min) to 1,000 ml/min]. The objective of micropurging is to remove a small volume of water at a low flow rate from a discrete portion of the screened interval of the well without disturbing stagnant water within the casing. Therefore, the well purge rate must never be greater than the recharge rate of the well. During purging, the water level in the well will be monitored to ensure that no drawdown in the well occurs. The water level monitoring will allow the sampling technician to control pumping rates to minimize drawdown. As long as no drawdown is observed during pumping, it may be assumed that the low pumping rate within the discrete, screened portion of the well has not pulled stagnant casing water into the sample.

The pH, temperature, dissolved oxygen, and specific conductivity will be continuously monitored during well purging using a flow-through cell. The flow-through cell will be attached directly to the discharge tubing of the peristaltic pump using Teflon®-lined polyethylene tubing. New tubing will be used at each well. Purging will continue until the parameters have stabilized (less than 0.2 standard **pH**~~ph~~ units or a 10-percent change for the other parameters over a 5-minute period) and the

water is clear and free of fines. Research conducted on low-flow micropurging has found that dissolved oxygen and specific conductance readings are the most useful field indicator parameters for stabilization of background water chemistry during purging (Barcelona, *et. al.*, 1994). The research also concluded that stabilization of dissolved oxygen and specific conductance shows some correlation to stabilization of VOC concentrations in "formation" waters.

All purge water will be placed in DOT-approved 55-gallon containers and stored in a secure area pending proper disposal

6.3.7 Sample Extraction

A peristaltic pump with new tubing for each well will be used to extract groundwater samples from the wells at the HWSA. If depth to groundwater exceeds approximately 21 feet it will be necessary to extract a sample using a **dedicated** bailer because of the vacuum lift limitations of a peristaltic pump. Both types of extraction equipment will be lowered into the water gently to prevent splashing and extracted gently to prevent creation of an excessive vacuum in the well. The sample will be transferred directly to the appropriate sample container. The water sample will be transferred from the bottom of the bailer using a bottom emptying device to allow a controlled flow into the sample container. Water from the peristaltic pump can be directly discharged into the sample container. The water should be carefully poured down the inner walls of the sample bottle to minimize aeration of the sample. Sample containers for VOC analysis will be filled at approximately 200 ml/min and all other sample collection rates will not exceed 400 ml/min. Volatile samples will be collected first, followed by any other analytical samples. Samples for field parameter analysis will be collected last.

Unless other instructions are given by the analytical laboratory, sample containers will be completely filled so that no air space remains in the container. Excess water collected during sampling will be placed into the 55-gallon containers used for well purge waters and disposed of **in accordance with applicable regulations**~~as directed by Rickenbacker ANGB personnel~~.

6.3.8 Onsite Chemical Parameter Measurement

Because many chemical parameters of a groundwater sample can change significantly within a short time following sample acquisition, these parameters will be measured in the field using Hach® or Chemetrics® test kits. Table 6.**2**~~1~~ lists the **field**~~chemical~~ analytical protocol for groundwater samples. The following discussion describes the field procedures for obtaining the onsite chemical parameter measurements. For information on individual instrument calibration procedures, **field personnel will maintain a copy of the specific calibration procedures on site, and these procedures will be available for inspection**~~please refer to the manufacture calibration procedure for the instrument~~.

Groundwater quality measurements such as temperature, **pH**~~ph~~, specific conductivity, dissolved oxygen, and reduction/oxidation (redox) potential will be continuously monitored during well purging using a flow-through cell. The flow-through cell will be attached directly to the discharge tubing of the peristaltic pump using Teflon®-lined polyethylene tubing. A new piece of tubing will be used for each well. All groundwater quality measuring equipment will be decontaminated following the procedures described herein. ~~The groundwater quality measuring equipment will be calibrated between each well following the manufacturer's recommended calibration procedures.~~ The measurements observed immediately before groundwater sampling begins will be considered the final measurements for the sample, and will be recorded in the field notebook and on the point-specific sampling form.

Groundwater quality measurements such as nitrate, nitrite, manganese, ferrous iron, ~~sulfate,~~ sulfide, and alkalinity will be measured in the field using Hach®, Chemetrics®, or similar field analysis methods. Groundwater samples for these measurements will be collected after all sample containers for laboratory analyses have been collected. Two 250-ML bottles of groundwater will be collected and capped for field analysis. The field analysis of groundwater samples should begin immediately after collection. Direct sunlight, contact with air, and high temperatures may greatly affect the concentrations of the analytes in question. If possible, analyses will be run indoors, and groundwater samples will be capped and stored in a cooler with a temperature maintained at 4°C when not in use. Duplicate analyses will be run at a frequency of **10**~~25~~ percent, or one duplicate sample for every **ten**~~four~~ field analyses **(see Section 6.6)**. One blank (distilled water) analysis will be performed for each sampling round.

6.3.9 LNAPL Sampling

If a sufficient thickness of LNAPL is detected in on-site monitoring wells, a sample of LNAPL will be obtained using either a peristaltic pump or a disposable Teflon® bailer. The tubing or bailer will be gently lowered into the well in an attempt to minimize agitation. The sample will be collected in a 40 milliliter glass bottle and submitted for laboratory analysis in accordance with Table 6.1. Excess water obtained during sample collection will be containerized, tested, and disposed of in accordance with applicable regulations.

6.3.10~~9~~ Sampling Records

In order to provide complete documentation of the sampling event, detailed records will be maintained by the field scientist. At a minimum, these records will include the following information:

- Sample location (facility name);
- Sample identification;
- Sample location map or detailed sketch;

- Date and time of sampling;
- Sampling method;
- Field observations of
  - Sample appearance,
  - Sample odor;
- Weather conditions;
- Water level prior to purging;
- Total well depth;
- Purge volume;
- Water level after purging;
- Well condition;
- Sampler's identification;
- Field measurements of pH, temperature, and specific conductivity; and
- Any other relevant information.

Groundwater sampling activities will be recorded on a groundwater sampling form or in the field scientist's field notebook. Figure 6.2 shows an example of the groundwater sampling record.

6.4 SAMPLE HANDLING

6.4.1 Sample Labels

The sample label will be firmly attached to the sample sleeve immediately after sample collection, and the following information will be legibly and indelibly written on the label:

- Facility name;
- Sample identification;
- Sample type (e.g., groundwater)
- Sample depth (soil only);

GROUND WATER SAMPLING RECORD - MONITORING WELL ______________________
(number)

REASON FOR SAMPLING: [X] Regular Sampling; [ ] Special Sampling;
DATE AND TIME OF SAMPLING: ____________, 1996 __________ a.m./p.m.
SAMPLE COLLECTED BY: ________ of __________
WEATHER: ______________________
DATUM FOR WATER DEPTH MEASUREMENT (Describe): ______________________

MONITORING WELL CONDITION:

[ ] LOCKED: [ ] UNLOCKED
WELL NUMBER (IS - IS NOT) APPARENT
STEEL CASING CONDITION IS: ______________________
INNER PVC CASING CONDITION IS: ______________________
WATER DEPTH MEASUREMENT DATUM (IS - IS NOT) APPARENT
[ ] DEFICIENCIES CORRECTED BY SAMPLE COLLECTOR
[ ] MONITORING WELL REQUIRED REPAIR (describe): ______________________

Check-off

1 [ ] EQUIPMENT CLEANED BEFORE USE WITH ______________________
Items Cleaned (List): ______________________

2 [ ] PRODUCT DEPTH ______________________ FT. BELOW DATUM
Measured with: ______________________

WATER DEPTH ______________________ FT. BELOW DATUM
Measured with: ______________________

3 [ ] WATER-CONDITION BEFORE WELL EVACUATION (Describe):
Appearance: ______________________
Odor: ______________________
Other Comments: ______________________

4 [ ] WELL EVACUATION:
Method: ______________________
Volume Removed: ______________________
Observations: Water (slightly - very) cloudy
Water level (rose - fell - no change)
Water odors: ______________________
Other comments: ______________________

FIGURE 6.2

GROUNDWATER SAMPLING RECORD

HWSA
Amended Closure/Post-Closure Plan
Rickenbacker ANGB, Ohio

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

Monitoring Well No. _______________ (Cont'd)

5 [ ] SAMPLE EXTRACTION METHOD:

[ ] Bailer made of:_______________
[ ] Pump, type:_
[ ] Other, describe:_______________

Sample obtained is [X] GRAB; [ ] COMPOSITE SAMPLE

6 [ ] ON-SITE MEASUREMENTS:

Temp: __________ ° C	Measured with:__________
pH: __________	Measured with:__________
Conductivity: __________	Measured with:__________
Dissolved Oxygen: __________	Measured with:__________
Redox Potential: __________	Measured with:__________
Salinity: __________	Measured with:__________
Nitrate: __________	Measured with:__________
Sulfate: __________	Measured with:__________
Ferrous Iron: __________	Measured with:__________

Other: _______________

7 [ ] SAMPLE CONTAINERS (material, number, size):_______________

8 [ ] ON-SITE SAMPLE TREATMENT:

[ ] Filtration:

Method__________	Containers:__________
Method__________	Containers:__________
Method__________	Containers:__________

[ ] Preservatives added:

Method__________	Containers:__________
Method__________	Containers:__________
Method__________	Containers:__________
Method__________	Containers:__________

9 [ ] CONTAINER HANDLING:

[ ] Container Sides Labeled
[ ] Container Lids Taped
[ ] Containers Placed in Ice Chest

10 [ ] OTHER COMMENTS:_______________

FIGURE 6.2
(Continued)

GROUNDWATER SAMPLING RECORD

HWSA
Amended Closure/Post-Closure Plan
Rickenbacker ANGB, Ohio

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

- Preservatives added;
- Sampling date;
- Sampling time;
- Sample collector's initials; and
- Requested analyses.

6.4.2 Sample Preservation

Samples will be properly prepared for transportation to the laboratory by placing the samples in an adequately padded cooler containing ice to maintain an approximate shipping temperature of 4 degrees centigrade (°C). **Additional sample preservation techniques are presented in Table 6.4.**

6.4.3 Sample Shipment

After the samples are sealed and labeled, they will be packaged for transport to the EPA-approved analytical laboratory. Samples will be shipped priority overnight via Federal Express®. The following packaging and labeling procedures will be followed:

- Package sample so that it will not leak, spill, or vaporize from its container;
- Label shipping container with:
  - Sample collector's name, address, and telephone number;
  - Laboratory's name, address, and telephone number;
  - Description of sample;
  - Quantity of sample; and
  - Date of shipment.

The packaged samples will be delivered to the laboratory as soon as possible after sample acquisition, and in accordance with analytical method-specific holding times.

6.4.4 Chain-Of-Custody Control

After the samples have been collected, chain-of-custody procedures will be followed to establish a written record of sample handling and movement between the sampling site and the laboratory. Each shipping container will have a chain-of-custody form completed in triplicate by the sampling personnel. One copy of this form will be kept by the sampling team and the other two copies will be sent to the laboratory. One of the laboratory copies will become a part of the permanent record for the sample and

will be returned with the sample analytical results. The chain-of-custody will contain the following information:

- Sample identification number;
- Sample collector's printed name and signature;
- Date and time of collection;
- Place and address of collection;
- Sample matrix;
- Analyses requested;
- Signatures of individuals involved in the chain of possession; and
- Inclusive dates of possession.

The chain-of-custody documentation will be placed inside the shipping container so that it will be immediately apparent to the laboratory personnel receiving the container, but will not be damaged or lost during transport. The shipping container will be sealed so that it will be obvious if the seal has been tampered with or broken.

6.5 QUALITY ASSURANCE/QUALITY CONTROL PROCEDURES AND SAMPLING AND POTENTIAL INTERFERENCES

Field QA/QC procedures will include collection of field duplicates and rinseate, field and trip blanks; decontamination of all equipment that contacts the sample medium before and after each use; use of analyte-appropriate containers; and chain-of-custody procedures for sample handling and tracking. All samples to be transferred to an onsite or offsite analytical laboratory for analysis will be clearly labeled to indicate sample number, location, matrix (e.g., groundwater), and analyses requested. Samples will be preserved in accordance with the analytical methods to be used and packaged in coolers with ice to maintain a temperature of approximately 4 ^{o}C.

All field sampling activities will be recorded in a bound, sequentially paginated field notebook in permanent ink. All sample collection entries will include the date, time, sample locations and numbers, notations of field observations, and the sampler's name and signature. Field QC samples will be collected in accordance with the program described below, and as summarized in Table 6.6~~2~~.

QA/QC sampling will include collection and analysis of duplicate samples, rinseate blanks, field/trip blanks, and matrix spike samples. Internal laboratory QC analyses will involve the analysis of laboratory control samples (LCS~~S~~) and laboratory method blanks ~~(LMBS)~~. QA/QC objectives for each of these samples, blanks, and spikes are described below.

TABLE 6.6
QA/QC SAMPLING PROGRAM
HAZARDOUS WASTE STORAGE AREA
AMMENDED CLOSURE/POST-CLOSURE PLAN
RICKENBACKER ANGB, OHIO

QA/QC Sample Types	Frequency to be Collected and/or Analyzed	Analytes or Analytical Methods
		VOCs, TPH
Duplicates/Replicates	10% of Samples per Matrix [a/]	VOCs
Rinseate Blanks	10% of Groundwater Samples [a/]	VOCs
Field Blanks	5% of Groundwater Samples [a/]	VOCs
Trip Blanks	One per shipping cooler containing VOC samples	VOCs
Matrix Spike Samples	Once per sampling event	VOCs
Laboratory Control Sample	Once per method per medium	Laboratory Control Charts (Method Specific)
Laboratory Method Blank	Once per method per medium	Laboratory Control Charts (Method Specific)

a/ Rounded to the next highest whole number.

One duplicate sample will be collected for every 10 or fewer samples collected, both for groundwater and soils. Volume permitting, duplicate samples will be collected at locations where low to moderate levels of contamination are believed to be present.

One rinseate sample will be collected for every 10 or fewer groundwater samples collected from existing wells. **Improperly decontaminated sampling equipment represents the primary field sampling inaccuracy resulting in a potential analytical interference. Equipment rinseate blanks are used to measure contamination introduced to a sample set as a result of improperly decontaminated equipment. Equipment rinseate blanks consist of distilled water (or equivalent) poured or pumped through the sampling device following decontamination.**~~If disposable bailers are used for this sampling event, the rinseate sample will consist of a sample of distilled water poured into a new disposable bailer and subsequently transferred into a sample container provided by the laboratory.~~

A field blank will be collected for every 20 or fewer groundwater samples (both from groundwater monitoring point and existing groundwater monitoring well sampling events) to assess the effects of ambient conditions in the field. The field blank will consist of a sample of distilled water poured into a laboratory-supplied sample container while sampling activities are underway. The field blank will be analyzed for VOCS.

A trip blank will be analyzed to assess the effects of ambient conditions on sampling results during the **storage and** transportation of samples. The trip blank **which** will be prepared by the laboratory **will be used to verify potential interferences resulting from ambient conditions or improper storage and handling**. A trip blank will be transported inside each cooler which contains samples for VOC analysis. Trip blanks will be analyzed for VOCS.

~~Matrix spikes will be prepared in the laboratory and used to establish matrix effects for samples analyzed for VOCS.~~

~~LCSS and LMBS will be prepared internally by the laboratory and will be analyzed each day samples from the site are analyzed. Samples will be reanalyzed in cases where the LCS or LMB are out of the control limits. Control charts for LCSS and LMBS will be developed by the laboratory and monitored for the analytical methods used.~~

Potential interferences resulting from laboratory analysis will be determined by laboratory confirmation of matrix effects and analysis of laboratory method blanks.

Method required quality control samples such as matrix spikes (MS) and surrogate spikes are used to indicated the accuracy of the analytical protocol in relation to the sample matrix. When the accuracy for MSs and surrogate spikes meets the method specified requirements, the quality control spikes fail specified

requirements, a matrix effect must be confirmed. Confirmation is done by evaluating quality control samples designed to show only instrument control, unrelated to matrix. This quality control sample is a laboratory control sample (LCS). When the LCS has met it's quality control requirements, and the MS and or the surrogate spike fails, a matrix affect is assumed.

Laboratory method blanks are designed to detect contamination of the field samples in the laboratory environment. Method blanks verify that interferences caused by contaminants in solvents, reagents, glassware, or in other sample processing hardware are known and minimized. The laboratory method blank will be American Society for Testing and Materials Type II water (or equivalent) for water samples, and a purified solid matrix (Ottawa sand or equivalent) for soil samples. The concentration of target compounds in the blanks must be less than the PQL. Exceptions are not made for common laboratory contaminants. If the blank contaminant concentration is not less than the specified limit, then the source of contamination will be identified, and corrective action will be taken.

6.6 CALIBRATION PROCEDURES AND FREQUENCY FOR FIELD TEST EQUIPMENT

Instruments and equipment used to gather, generate, or measure environmental data in the field will be calibrated with sufficient frequency and in such a manner that accuracy and reproducibility of results are consistent with the manufacturer's specifications. Field instruments may include a pH meter, digital thermometer, O_2/CO_2 meter, TVH meter, photoionization detector, specific conductivity meter, dissolved oxygen meter, oxidation reduction potential meter, and Hach® spectrophotometer. A summary of calibration frequency and acceptance criteria is presented in Table 6.7.

6.7 DETERMINING CONTAMINANT MIGRATION RATES

Biodegradation rate constants are necessary to accurately estimate contaminant migration rates at the HWSA. Biodegradation of both fuel hydrocarbons and CAHs can generally be approximated using first-order kinetics. In order to calculate first-order biodegradation rate constants, the apparent degradation rate must be normalized for the effects of dilution and volatilization. Two methods can be employed for determining first-order rate constants. One method involves using either biologically recalcitrant compounds normally found in BTEX plumes (i.e., the trimethyl and tetramethyl benzene isomers) or the carbon core of the CAH compounds as a conservative tracer. In these types of methods, the measured tracer and contaminant concentrations are taken from a minimum of two points along a flow path. A simple proportional equation is used to estimate the theoretical concentration resulting from biodegradation alone for every point along a flow path on the basis of the measured contaminant concentration and the contaminant/tracer ratios between consecutive points along the flow path. The

TABLE 6.7
CALIBRATION OF EQUIPMENT FOR FIELD SCREENING
HAZARDOUS WASTE STORAGE AREA
RICKENBACKER ANGB, OHIO

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action[a/]	Reporting Limit
SW9050	Conductance	Calibration with potassium chloride standard	Once per day at beginning of testing	± 5%	If calibration is not achieved, check meter, standards, and probe; recalibrate	0.02 µmhos/cm
SW9040	pH (water)	2-point calibration with pH buffers	Once per day at beginning of testing	± 0.05 pH units for every buffer	If calibration is not achieved, check meter, buffer solutions, and probe; replace if necessary; repeat calibration	pH units
		pH 7 buffer	At each sample location	± 0.1 pH units	Correct problem, recalibrate	
E170.1	Temperature	Check against a mercury thermometer	Once per day at beginning of testing	± 1.0°C[b/]	Correct problem, repeat measurement	°C
ASTM[c/] D1498	Oxidation-reduction potential	Calibration with one standard	Once per day at beginning of testing	Two successive readings ± 10 millivolts	Correct problem, recalibrate	pe[d/] units
Hach™ 8221	Alkalinity	Accuracy check, (3 concentration points)	Once per day	± 50 %	Correct problem by standard solutions, and optical cell; replace if necessary; repeat calibration check	20.0 mg/L[e/]
E360.1	Dissolved oxygen	Calibration check with one standard, and zero meter with sodium sulfate solution	Once per day at beginning of testing	± 5 %	Correct problem by checking meter, standard solutions, replace if necessary; repeat calibration check	0.5 mg/L

TABLE 6.7 (Continued)
CALIBRATION OF EQUIPMENT FOR FIELD SCREENING
HAZARDOUS WASTE STORAGE AREA
RICKENBACKER ANGB, OHIO

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action[a/]	Reporting Limit
HACH™ 8039	Nitrate (NO_3)	Calibration check with one standard, and zero meter w/sodium sulfate solution	Once per day at beginning of testing	± 5 %	Correct problem by checking meter, standard solutions, replace if necessary; repeat calibration check	0.07 mg/L
		Accuracy check, (3 concentration points)	Once per day	± 50 %	Correct problem by checking meter, standard solutions, and optical cell; replace if necessary; repeat calibration check	
HACH™ 8040	Nitrite (NO_2)	Calibration check with one standard	Once per day at beginning of testing	± 50 %	Correct problem by checking meter, standard solutions, and optical cell; replace if necessary; repeat calibration check	0.01 mg/L
		Accuracy check, (3 concentration points)	Once per day	± 50 %	Correct problem by checking meter, standard solutions, and optical cell; replace if necessary; repeat calibration check	
Hach™ 8146	Ferrous Iron (Fe^{2+})	Calibration check with one standard	Once per day at beginning of testing	± 50 %	Correct problem by checking meter, standard solutions, and optical cell; replace if necessary; repeat calibration check	0.024 mg/L
		Accuracy check, (3 concentration points)	Once per day	± 50 %	Correct problem by checking meter, standard solutions, and optical cell; replace if necessary; repeat calibration check	

TABLE 6.7 (Continued)
CALIBRATION OF EQUIPMENT FOR FIELD SCREENING
HAZARDOUS WASTE STORAGE AREA
RICKENBACKER ANGB, OHIO

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action[a/]	Reporting Limit
Hach™ 8034	Manganese	Calibration check with one standard	Once per day at beginning of testing	± 50 %	Correct problem by checking meter, standard solutions, and optical cell; replace if necessary; repeat calibration check	0.024 mg/L
		Accuracy check, (3 concentration points)	Once per day	± 50 %	Correct problem by checking meter, standard solutions, and optical cell; replace if necessary; repeat calibration check	
HACH™ 8131	Sulfide (S^{-2})	Calibration check with one standard	Once per day at beginning of testing	± 50 %	Correct problem by checking meter, standard solutions, and optical cell; replace if necessary; repeat calibration check	NA[f/]
		Accuracy check, (3 concentration points)	Once per day	± 50 %	Correct problem by checking meter, standard solutions, and optical cell; replace if necessary; repeat calibration check	
TVH[g/] Meter	Volatile Hydrocarbons	Calibration with hexane standard	Once per day at beginning of testing	± 10 %	Correct problem by checking meter; repeat calibration check	ppmv[h/]
PID[i/]	Volatile Organics	Calibration with isobutylene standard	Once per day at beginning of testing	± 10 %	Correct problem by checking meter and lamp; repeat calibration check	ppmv

a/ All corrective actions will be documented.
b/ °C = degrees Celsius.
c/ ASTM = American Society for Testing and Materials.
d/ pe = potential platinum electrode.
e/ mg/L = milligrams per liter.
f/ NA = not applicable.
g/ TVH = total volatile hydrocarbons.
h ppmv = parts per million, volume per volume.
i/ PID = photoionization detector.

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other method, proposed by Busckeck and Alcantar (1995) involves interpretation of a steady-state contaminant plume and is based on the one-dimensional steady-state analytical solution to the advection-dispersion equation presented by Bear (1979). In summary, this method involves coupling the regression of contaminant concentration (plotted on a logarithmic scale) versus distance downgradient (plotted on a linear scale) to an analytical solution for one-dimensional, steady-state, contaminant transport that includes advection, dispersion, sorption, and biodegradation. All of these methods are fully described in two AFCEE technical protocols (Wiedemeier *et al.,* 1995; Wiedemeier *et al.,* in progress). Once the biodegradation rate constants are defined for the site from each assessment sampling event, these data can be coupled to estimates of contaminant retardation and groundwater flow velocity to yield site-specific contaminant migration rates. Subsequent groundwater assessment reports submitted for the HWSA will use these types of quantitative techniques to evaluate contaminant migration rates and assess the effectiveness of natural attenuation processes at complementing engineered remedial techniques.

SECTION 7

HEALTH AND SAFETY PLAN

The purpose of this plan is to outline the protection standards and mandatory safety practices for all personnel involved in closure activities for the HWSA at Rickenbacker ANGB. The provisions of this plan are mandatory for all onsite investigations related to this closure plan. Any supplemental plans used by subcontractors will conform to this plan as a minimum. This plan provides general health and safety guidance for site operations. Specific health and safety guidance is deferred to individual task program managers and health and safety officers.

7.1 PROGRAM HEALTH AND SAFETY OFFICER

The task health and safety officer will be responsible for developing a site specific training program to be presented to all personnel working at the site. The training will be conducted before work commences, and will include the following topics:

- Names of personnel responsible for site health and safety;
- Acute effects of compounds at the site;
- OSHA regulations;
- Safety, health and other hazards at the site;
- Work practices by which employees can minimize risk from hazards;
- Decontamination procedures; and
- Proper use of personnel protection equipment.

The task health and safety officer will also conduct daily briefings to discuss specific procedures and hazards which will be encountered that day and will ensure that field practices are consistent with the guidelines provided in OSHA's 29 CFR 1910.120, 1910.132, 1910.1200, and 1926, USEPA's Occupational Health and Safety Manual, and Chapter 9 of the USEPA's Standard Operating Safety Guidelines. The task health and safety officer is also responsible for maintaining all employee training and medical monitoring documentation.

7.2 SITE-SPECIFIC EMPLOYEE TRAINING AND MEDICAL MONITORING

All field team members will have received the 40-hour Occupational Safety and Health Administration (OSHA) training as specified in Title 29 Code of Federal

Regulations 1910.120, a current 8-hour annual refresher course and site-specific training. All field team members will be on appropriate and current medical monitoring programs. All personnel engaged in site supervisory positions will have completed the 8-hour OSHA supervisory training as specified in 29 CFR 1910.120(E). Additional training may be required for personnel involved in Level B (supplied air) respiratory protection, should that level of protection be necessary. Weekly safety briefings will be conducted if necessary.

7.3 SITE HAZARDS

7.3.1 Chemical Hazards

A number of products containing hazardous chemicals may be encountered during the implementation of this closure plan. Hazardous chemicals suspected to be present at the HWSA include fuel hydrocarbons and chlorinated solvents in soils and groundwater. If other compounds are discovered, the health and safety plan will be amended. The health hazard qualities of chemicals that may be encountered must be communicated to onsite employees.

7.3.2 Physical Hazards

In addition to the potential exposure to hazardous substances during the implementation of the closure plan, other physical hazards or hazardous conditions may be expected at the site due to the use of heavy equipment during soil gas surveys, monitoring well installation, installation and testing of both the soil and groundwater remedial systems, and groundwater and soils investigation. These include possible risks of injury while working with electrical equipment, in or around abandoned or moving equipment, and/ or heat stress and cold-related exposures. Work areas should therefore be cordoned off to protect both public and operational personnel. Additional information concerning task specific physical hazards are deferred to the task health and safety plans.

7.3.2.1 Electrical Safety

Some of the equipment used during implementation is operated by electricity. Maintenance and day-to-day activities require personnel to handle and control this equipment. Unless safe work practices are strictly observed, serious injury or death can result.

Ordinary 120 volt (v) electricity may be fatal. Extensive studies have shown that currents as low as 10 to 15 milliamps (MA) can cause loss of muscle control and that 12 V may, on good contact, cause injury. Therefore, all voltages should be considered dangerous. All electricity should be treated cautiously by trained personnel.

Electricity kills by paralyzing the nervous system and stopping muscular action. Frequently, electricity may hit the breathing center at the base of the brain and interrupt the transmission of the nervous impulses to the muscles responsible for breathing. In other cases, the electrical current directly affects the heart, causing it to cease pumping blood. Death follows from lack of oxygen in the body. It cannot be determined which action has taken place, therefore, a victim must be freed from the live conductor

promptly by use of a dry stick or other nonconductor or by turning off the electricity to at least this point of contact. Never use bare hands to remove a live wire from a victim or a victim from an electrical source. Artificial respiration or CPR should be applied immediately and continuously until breathing is restored, or until a doctor or emergency medical technician arrives.

7.3.2.1.1 General Electrical Safety Rules

- As long as you are not grounded, (i.e., as long as current cannot pass through your body to the ground) you are safe. While working on electrical circuits, do not touch the switch box cabinet or any other object, such as a pipe, that will give electric current a path through your body. Do not stand in water and, if possible, place a rubber mat under your feet.
- Allow only authorized people to work on electrical panels.
- Keep rubber mats in front of electrical panels.
- Treat all electrical wires and circuits as "live," unless certain they are not.
- Use approved rubber gloves.
- Electrical control panels should never be opened unless the job requires it.
- No part of the body should be used to test a circuit.
- Always work from a firm base as loss of balance may cause a fall onto energized busses or parts, which should be covered with a good electrical insulator such as a rubber blanket.
- No safety device should be made inoperative by removing guards, using oversized fuses, or blocking or bypassing protective devices, unless it is absolutely essential to the repair or maintenance activity, and then only after alerting operating personnel and the maintenance supervisor.
- All tools should have insulated handles, be electrically grounded, or be double insulated.
- Jewelry should never be worn when working on electric circuits.
- Use fuse pullers to change fuses.
- Never use metal ladders, metal tape measures, or other metal tools around electrical equipment.
- Keep wires from becoming a tripping hazard.
- When performing electrical work, even simply energizing a piece of equipment, observe "no smoking" signs.

- When working around electrical equipment, keep your mind on the potential hazards at all times.

7.3.2.1.2 Holding and Locking Out Electrical Circuits

The most important safety requirement in electrical maintenance is to have and adhere to a good system for holding and locking out electrical circuits when equipment is being repaired. Unexpected operation of electrical equipment that can be started by automatic or manual remote control may cause injuries to persons who happen to be close enough to be struck.

When motors or electrical equipment require repair, the circuit should be opened at the switch box, and the switch should be padlocked in the "off" position.

All personnel involved in maintenance work should be instructed in the following lockout procedure:

- Alert the affected personnel.

- Before starting work on an engine, motor line shaft, or other power transmission equipment, or power driven machine, make sure it cannot be set in motion without your permission.

- Place your own padlock on the control switch, lever, or valve, even though someone may have already locked the control. You will not be protected unless you put your own padlock on it.

- When through working at the end of your shift, remove your padlock; never permit someone else to remove it for you; and be sure you are not exposing another person to danger by removing your padlock.

- After repair, clear personnel from area before closing the breaker.

Further information concerning lockout/tag out procedures can be found in 29 CFR Part 169.

7.3.2.2 FIRE SAFETY

Fuel and solvents have been released into the soils at the HWSA and vapors escaping from the soils may be flammable or explosive (if in a confined space). Therefore, precautions should be taken when performing field work (drilling or well construction/installation) to ensure that combustible or explosive vapors have not accumulated, or that an ignition source is not introduced into a flammable atmosphere. An explosivity meter will be used during construction to monitor work in areas where a potentially explosive atmosphere exists. Tools used in areas with potentially explosive atmospheres will be of nonsparking design and materials.

OSHA standards for fire protection and prevention are contained in 29 CFR Subpart F, 1926.150 through 1926.154. Of particular concern are:

- Proper storage of flammables;

- Adequate numbers and types of fire extinguishers;
- Use of intrinsically safe or explosion proof equipment where appropriate;
- Monitoring for development of an explosive atmosphere; and
- Prevention of explosive atmospheres by placing flammable equipment in well-ventilated enclosures.

7.3.2.3 Motor Vehicles and Heavy Equipment

Working with large motor vehicles and heavy equipment could be a major hazard at the HWSA. Injuries can result from equipment dislodging and striking unsuspecting personnel, and impacts from flying objects or overturning of vehicles. Vehicles and heavy equipment design and operation will be in accordance with 29 CFR, Subpart 0, 1926.600 through 1926.602. In particular, the following precautions will be used to help prevent injuries and accidents:

- Drill rig brakes, hydraulic lines, light signals, fire extinguishers, fluid levels, steering, tires, horn, and other safety devices will be checked and recorded routinely throughout the project.
- Do not back up large construction motor vehicles unless the vehicle has a reverse signal alarm (audible above the surrounding noise level) and backup warning lights, or when an observer signals it is safe to do so.
- Heavy equipment or motor vehicle cabs will be kept free of all nonessential items and all loose items will be secured.
- Construction and heavy equipment will be provided with necessary safety equipment including seat belts, rollover protection, emergency shutoff during rollover, backup warning lights, and audible alarms.
- Blades and buckets will be lowered to the ground and parking brakes will be set before shutting off any heavy equipment or vehicle.

Typical hazards associated with drilling activities include suspended loads dropping on employees, being caught between a load and a stationary object, or being struck by counterweights. They can be prevented or their impact minimized by the safe operation of drilling equipment, wearing protective equipment including a hard hat and safety boots, and routinely inspecting drilling/cone penetrometer equipment to identify unsafe conditions (e.g., frayed ropes).

7.3.2.4 Electrical Line Clearance and Thunderstorms

Extra precautions will be exercised when drilling near overhead electrical lines. The minimum clearance between overhead electrical lines of 50 kilovolts (Kv) or less and the drill rig is 10 feet. For lines rated over 50 Kv, the minimum clearance between the lines and any part of the rig is 10 feet plus 0.4 inches for each Kv over 50 Kv. **Because the power rating of overhead lines is not typically known, a 20-foot**

minimum distance will be maintained between the drill rig and overhead power lines. Drilling operations must cease during thunderstorms.

Onsite surveillance of the drilling subcontractor should be provided to ensure that personnel meet these requirements. If deficiencies are noted, work will be stopped and corrective actions implemented. Reports of health and safety deficiencies and the corrective actions taken will be forwarded to the installation manager.

7.3.2.5 Slip, Trip and Fall Hazards

The HWSA site could contain a number of slip, trip and fall hazards for site workers, such as:

- Holes, pits, or ditches;
- Slippery surfaces;
- Steep grades;
- Uneven grades; and
- Sharp objects.

Site personnel will be instructed to look for potential safety hazards and immediately inform the site health and safety officer **(SHSO)** or the site manager about any new hazards. If the hazard cannot be immediately removed, actions must be taken to warn site workers about the hazard.

7.3.2.6 Excavation Activities

Prior to initiation of any excavation activities the location, if any, of underground installations such as sewers, telephone, water, fuel, and electric lines must be determined. The walls and faces of all excavations in which personnel are exposed to danger from moving ground must be guarded by a shoring system, sloping of the ground, or by some other equivalent means.

Excavations (greater than 4 feet deep) must be inspected by a competent person, as defined in OSHA, after every rainstorm or other hazard increasing occurrence, and the protection against slides and cave-ins will be increased if necessary. All OSHA requirements concerning excavation activities, contained in 29 CFR 1926.651, must be followed.

7.3.2.7 Subsurface Hazards

Before ground penetration activities are initiated, efforts must be made to determine whether underground installations, (e.g., sewers, telephone, water, fuel, and electric lines) will be encountered and, if so, where such underground installations are located. Utility companies or the base engineer will be contacted by the field team leader prior to commencing intrusive operations and the necessary clearances obtained.

7.3.2.8 Noise-Induced Hearing Loss

Work onsite will involve the use of heavy equipment such as a drill rig, compressor, generator, and excavation equipment. The unprotected exposure of site workers to this noise or to aircraft noise during activities near runways or aircraft can result in noise induced hearing loss. The SHSO will ensure that either ear muffs or disposable foam earplugs are made available to, and used by, all personnel in the vicinity of the operation of heavy equipment, aircraft noise, or other sources of high intensity noise.

7.3.2.9 Heat Stress and Cold-Related Illness

Adverse weather conditions are important considerations in planning and conducting site operations. Hot or cold weather can cause physical discomfort, loss of efficiency, and personal injury. Of particular importance is heat stress resulting when temperatures are moderate or when employees are wearing impermeable clothing.

Heat stress: Heat stress can result when protective clothing decreases natural body ventilation. Heat stress can occur even when temperatures are moderate if employees are wearing impermeable protective clothing.

Cold-related illness: If work on this project is conducted in the winter months, thermal injury due to cold exposure can become a problem for field personnel. Cold exposure symptoms, including hypothermia and frostbite, should be monitored when workers are exposed to low temperatures for extended periods of time.

7.4 PERSONNEL ROLES, LINES OF AUTHORITY, AND COMMUNICATION PROCEDURES DURING AN EMERGENCY

When an emergency occurs, decisive action is required. Rapidly made choices may have far reaching, long-term consequences. Delays of minutes can create life threatening situations. Personnel must be ready to respond to emergency situations immediately. All personnel should know their own responsibilities during an emergency, know who is in charge during an emergency, and know the extent of that person's authority. This section outlines personnel roles, lines of authority, and communication procedures during emergencies.

In the event of an emergency situation at a site, the site manager and the SHSO will assume total control and will be responsible for onsite decision making. These individuals have the authority to resolve all disputes about health and safety requirements and precautions. They will also be responsible for coordinating all activities until emergency response teams (ambulance, fire department, etc.) arrive onsite.

The site manager will ensure that the necessary air force personnel, field personnel, and agencies are contacted as soon as possible after the emergency occurs. All onsite personnel must know the location of the nearest telephone and the location of the emergency telephone number.

7.4.1 Evacuation Routes and Procedures, Safe Distances, and Places of Refuge

In the event of emergency conditions, employees will evacuate the area as instructed, transport injured personnel, or take other measures to mitigate the situation. Evacuation routes and safe distances will be decided upon and posted prior to initiating work.

7.4.2 Decontamination of Personnel During an Emergency

Procedures for leaving a contaminated area must be planned and implemented prior to going onsite. Work areas and decontamination procedures must be established based on expected site conditions. If a member of the field crew is exposed to chemicals, the emergency procedures outlined below should be followed:

- Another team member (buddy) should assist or remove the individual from the immediate area of contamination to an upwind location if it is safe to do so.
- Precautions should be taken to avoid exposure of other individuals to the chemical.
- If the chemical is on the individual's clothing, the clothing should be removed if it is safe to do so.
- Administer first aid and transport the victim to the nearest medical facility, if necessary.

If uninjured employees are required to evacuate a contaminated area in an emergency situation, emergency decontamination procedures should be followed. At a minimum these procedures would involve moving into a safe area and removing protective equipment. Care should be taken to minimize contamination of the safe area and personnel. Contaminated clothing should be placed in plastic garbage bags or other suitable containers. Employees should wash or shower as soon as possible.

7.4.3 EMERGENCY SITE SECURITY AND CONTROL

For this project, the site manager (or designated representative) must know who is onsite and who is in the work area. Personnel access into the work area should be controlled. In an emergency situation, only necessary rescue and response personnel should be allowed into the exclusion zone.

7.5 PROCEDURES FOR EMERGENCY MEDICAL TREATMENT AND FIRST AID

7.5.1 Chemical Exposure

In the event of chemical exposure (skin contact, inhalation, ingestion) the following procedures should be implemented:

- Another team member (buddy) should assist or remove the individual from the immediate area of contamination to an upwind location if it is safe to do so.

- Precautions should be taken to avoid exposure of other individuals to the chemical.
- If the chemical is on the individual's clothing, the clothing should be removed if it is safe to do so.
- If the chemical has contacted the skin, the skin should be washed with copious amounts of water, preferably under a shower.
- In case of eye contact, an emergency eye wash should be used. Eyes should be washed for at least 15 minutes.
- If necessary, the victim should be transported to the nearest hospital or medical center. If necessary, an ambulance should be called to transport the victim.

7.5.2 Personal Injury

In the event of personal injury:

- Field team members trained in first aid can administer treatment to an injured worker.
- The victim should be transported to the nearest hospital or medical center. If necessary, an ambulance should be called to transport the victim.
- The field supervisor is responsible for the completion of an accident report form.

7.5.3 Fire or Explosion

In the event of fire or explosion, personnel will evacuate the area immediately and administer necessary first aid to injured employees. Personnel will proceed to a safe area and telephone the emergency support services. Upon contacting the emergency support services, the caller should state his/her name, nature of the hazard (fire, high combustible vapor levels), the location of the incident, and whether there were any physical injuries requiring an ambulance. Do not hang up until emergency support services has all of the additional information they may require.

7.6 PERSONAL PROTECTIVE EQUIPMENT

The personal protection level prescribed for the project is OSHA Level D (no respiratory or chemical protective clothing), with a contingency for the use of OSHA Level C or B as site conditions require. Unless certain compounds are ruled out through use of appropriate air monitoring techniques such as dräger tubes, portable sampling pumps, or an onsite gas chromatograph (gc), Level C respiratory protection [air-purifying respirator (apr)] cannot be used. Level C protection may only be used on this project when vapors in air are adequately identified and quantified and Level C respirator-use criteria are met. Level B (supplied air) respiratory protection must be used on this project in the presence of unknown vapor constituents or if benzene is detected at or above 1 ppmv. This is based on the toxicity and warning properties

(high odor threshold) for benzene. Air monitoring must be conducted in the worker breathing zone when the potential occurrence of these compounds exists.

Ambient air monitoring of organic gases/vapors (using photoionization detectors such as an HNU® or PHOTOVAC® tip or by colorimetric analysis with DRÄGER® tubes) will be used to select the appropriate level of personal protection. If the portable air monitoring equipment indicates organic vapor concentrations of 0-5 ppmv, site workers will continue air monitoring in a Level D ensemble. If organic vapors reach 5-25 ppmv for more than 30 seconds, and/or benzene concentrations exceed 1 ppmv, site workers will evacuate the area or upgrade to Level B ensemble, if trained to do so. If benzene concentrations are less than 1 ppmv in the breathing zone, the site crews may continue in Level D ensemble with periodic air monitoring. If organic vapor concentrations reach 25-50 ppmv for greater than 30 seconds and benzene concentrations exceed 1 ppmv, site crews will evacuate the site or upgrade to Level b ensemble. If benzene concentrations are less than 1 ppmv, and vapors are in the range of 25-50 ppmv, site workers will don full facepiece air-purifying respirators (APR) equipped with organic vapor cartridges (NIOSH approved), and continue periodic monitoring. If organic vapor concentrations reach 50-500 ppmv for greater than 30 seconds, site crews will evacuate the site or upgrade to Level B ensemble. If organic vapor concentrations exceed 500 ppmv for greater than 30 seconds, site crews will evacuate the site. The site health and safety officer will determine when changes in the level of respiratory protection are appropriate.

The following personal protective ensemble is required only when handling contaminated samples or equipment.

Mandatory Equipment	Optional Equipment
Vinyl or Latex Inner Gloves	Air Purifying Respirator (equipped with
Neoprene or Silver Shield/Outer Gloves	organic vapor/high Efficiency Particulate
Steel-Toed, Steel Shank Work Boots	Air [HEPA] Catridges)
	Self-Contained Breathing Apparatus (SCBA) or Air-Line Respirator in Pressure-Demand Mode
	Leather or Rubber Safety Boots
	Disposable Tyvek/Coveralls
	Outer Disposable Boot Covers
	Saranex/Suits
	Chemical Goggles
	Hard Hat

Each field team shall have the following items readily available:

- Copy of this health and safety plan, including a separate list of emergency contacts;
- First aid kit;

- Eye wash bottle;
- Paper towels;
- Duct tape;
- Water; and
- Plastic garbage bags.

7.7 SITE CONTROL MEASURES

The following site control measures will be followed in order to minimize potential contamination of workers, protect the public from potential site hazards, and to control access to the site. Site control involves the physical arrangement and control of the operation zones (i.e., site organization) and the methods for removing contaminants from workers and equipment. Site organization is discussed in this section.

7.7.1 Site Operation Zones

Any time respirators are worn, the following operation zones will be established on the site or around a particular site feature (such as the drill rig):

- Exclusion zone (or contamination zone)
- Contamination-reduction zone
- Support zone.

If protective clothing, such as gloves and/or TYVEK suits, are worn but respirators are not worn (Level D-modified), the field crew will establish a decontamination area to avoid spreading contaminants offsite. The field team leader and/or site safety officer will be responsible for establishing the size and distance between zones at the site or around the site feature. Professional judgment is required to assure safe working distances for each zone are balanced against practical work considerations.

7.7.1.1 Exclusion Zone (Contamination Zone)

The exclusion zone is the place within which active investigation or cleanup operations occur. Within the exclusion zone, prescribed levels of protection must be worn by all personnel. The hotline, or exclusion zone boundary, is initially established based upon the presence of actual wastes or apparent spilled material, or through air monitoring, and is designated to encompass all physical indicators of hazardous substances (e.g., drums, ponds, tanks, liquid runoff defoliated areas). The hotline may be readjusted based upon subsequent observations and measurements. This boundary should be physically secure and posted or well-defined by physical and geographic boundaries.

Under some circumstances, the exclusion zone may be subdivided into zones based upon environmental measurements or expected onsite work conditions. An exclusion

zone will be established around the drill rig or other appropriate site features if Level C or B protection is required.

7.7.1.2 Contamination-Reduction Zone

Between the exclusion zone and the support zone is the contamination-reduction zone. This zone provides an area to prevent or reduce the transfer of hazardous materials which may have been picked up by personnel or equipment leaving the exclusion area. All decontamination activities occur in this area.

7.7.1.3 Support Zone

The support zone is the outermost area of the site and is considered a noncontaminated or clean area. The support zone contains the command post for field operations, first aid stations, and other investigation and cleanup support. Normal work clothes are appropriate apparel within this zone; potentially contaminated personnel clothing, equipment, etc., are not permitted.

7.7.2 Site Security

The site is currently surrounded by a 6-foot chain-link fence with locking gate. It is anticipated that this fence will remain throughout the course of the closure (**Figure 1.3**~~see Sheet 9~~). Access to the site is limited further by overall base security. A guard is on duty 24 hours per day at the Base gate.

Warning signs stating:

"DANGER - UNAUTHORIZED PERSONNEL KEEP OUT,"

or similar language will be posted around the permanent and temporary fencing. These site security measures meet the requirements of 40 CFR 265.14.

Site security will be enforced by the site health and safety officer who will ensure that only authorized personnel are allowed in the work area and that entry personnel have the required level of PPE, are trained under the requirements of 29 CFR 1910.120, and are on a current medical monitoring program.

Site security is necessary to prevent exposure of unauthorized, unprotected individuals in the work area. The areas immediately surrounding the work area will be clearly marked through use of warning signs, traffic cones, barrier tape, rope, or other suitable means.

7.7.3 Site Communication

Internal site communication is necessary to alert field team members in the exclusion zone and contamination-reduction zone of emergency conditions, to convey safety information, and to communicate changes or clarification in the work to be performed. For internal site communication, the field team members will use prearranged hand signals (and responses). Radios and/or compressed air horns may also be used for communication.

External site communication is necessary to coordinate emergency response teams and to maintain contact with essential offsite personnel. A telephone will be available for use in external site communication.

7.7.4 Safe Work Practices

To ensure a strong safety awareness program during field operations, personnel shall have adequate training, this health and safety plan must be communicated to the employees, and standing work orders developed and communicated to the employees. Sample standing orders for personnel entering the contamination-reduction zone and exclusion zone are as follows:

- No smoking, eating, drinking;
- No matches/lighters in the zone;
- Check in/check out at access control points;
- Use the buddy system;
- Wear appropriate PPE;
- Avoid walking through puddles or stained soil;
- Discovery of unusual or unexpected conditions will result in immediate evaluation and reassessment of site conditions and health and safety practices;
- Conduct safety briefings prior to onsite work;
- Conduct daily/weekly safety meetings as necessary; and
- Take precautions to reduce injuries from heavy equipment and other tools.

The following guidelines will be followed while working onsite:

- Heavy Equipment - Only qualified operators will be allowed to operate heavy equipment. Subcontractors will be required to use the safe work guidelines included in the OSHA general industry (29 CFR 1910) and construction industry (29 CFR 1926) Standards.
- Trench Shoring - Any trenches for human entry that are more than 5 feet deep will be shored or have the sides laid back in accordance with 29 CFR 1926 Subpart P. All trenching and shoring will be inspected on a daily basis by the SHSO.
- Power Lines - When operating heavy equipment such as drilling rigs near power lines, workers will take care to ensure that the boom or rigging always maintains a safe distance (20-foot minimum) from power lines. Any underground utility lines must also be located, and appropriate measures taken before any excavation work or drilling is done.

- Swing Radius - All swing equipment, such as cranes or backhoes, will have the swing radius guarded to prevent workers from being struck by the rotating machinery.

- Electrical Equipment - All electrical equipment will be properly grounded and class approved for the location.

- Machine Guarding - All machinery onsite will be properly guarded to prevent contact with rotating shafts, blades, or gears.

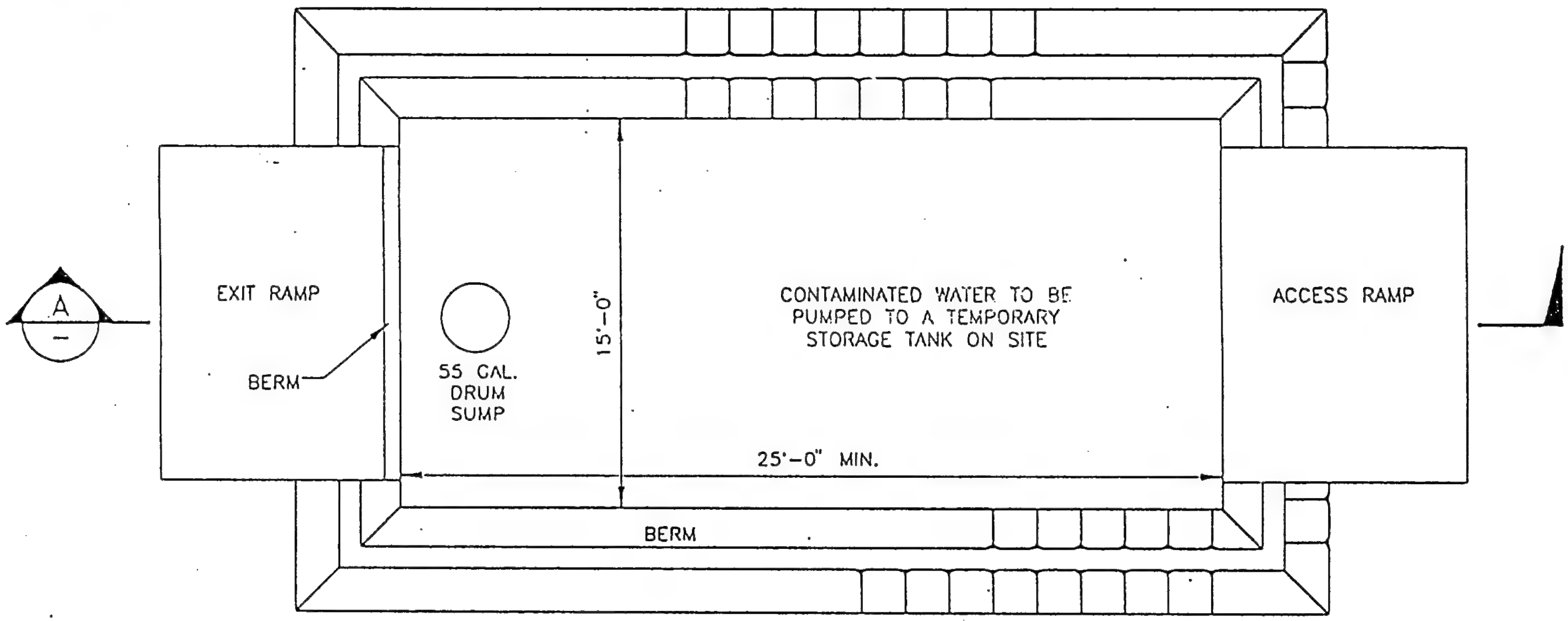
- Flammable Materials - When work involves flammable materials, adequate ventilating and control of all ignition sources will be maintained. Preventative measures may include:

  - Nonsparking tools, no welding,
  - Explosion-proof equipment (intrinsically safe),
  - Class-approved electrical equipment,
  - Grounding and bonding of static electricity sources, and
  - No smoking or open lights.

7.8 PERSONNEL AND EQUIPMENT DECONTAMINATION PROCEDURES

An exclusion zone, contamination-reduction zone, and support zone will be established whenever field personnel are using Level C or B respiratory protection. Decontamination station layout will be made on a site-specific basis and will be designed to accommodate the particular PPE worn by employees and the types of chemical hazards encountered. Defined access and egress points will be established and personnel will enter and exit only through these points. A schematic of the decontamination pad used as part of Building 560 decontamination activities (SECTION 5) is presented in Figure 7.1.

If personnel are in Level D-modified protection (no respirator but using protective gloves and/or suits and other equipment), a portable decontamination station will be set up at the site at the site actively under investigation. The decontamination station will include provisions for collecting disposable personal protective equipment (PPE) (such as Tyvek® suits, gloves, etc.); washing boots, gloves, vinyl rainsuits (if used), and field instruments and tools; and washing hands, face, and other exposed body parts. Onsite personnel will shower upon return to their hotel or homes at the end of the work day. Refuse from decontamination will be bagged and left onsite for proper disposal.



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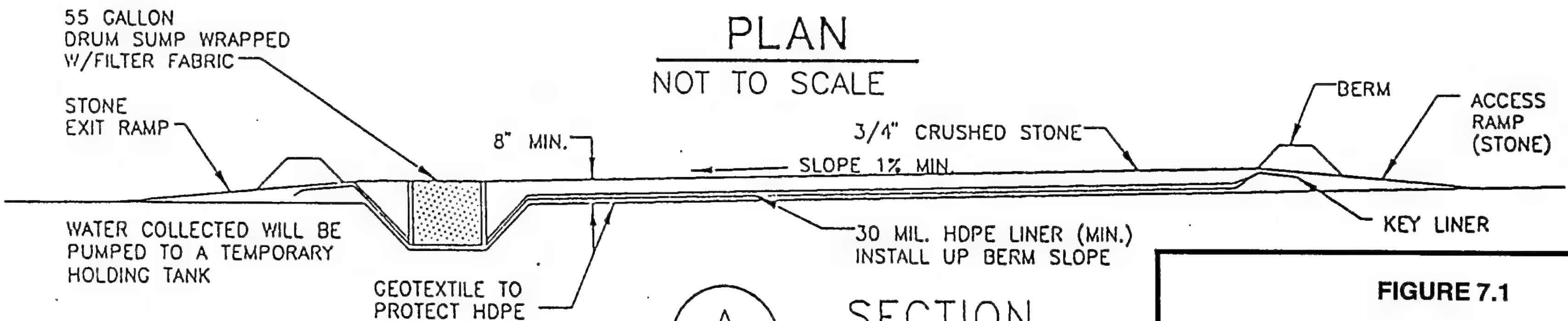

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NOTES:

- BERM MATERIAL FROM EXISTING GROUND SURFACE
- DECON. PAD WILL BE COVERED WITH 30 MIL. HDPE LINER TO RESTRICT CONTAMINATION

FIGURE 7.1

TEMPORARY DECONTAMINATION PAD

HWSA
Amended Closure/Post-Closure Plan
Rickenbacker ANGB, Ohio

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

7.9 EQUIPMENT DECONTAMINATION

Decontamination of drilling rigs and testing equipment will be conducted at a location onsite where the rinseate can be collected. High-pressure steam cleaning of drilling rigs and cone penetrometer testing equipment will be necessary prior to the start of the drilling operation, between borehole locations, and before the drill rig leaves the project site. All sampling equipment will be decontaminated prior to use, between samples, and between sampling locations. Sampling equipment should be thoroughly washed with detergent, followed by clean water rinse, solvent (methanol) rinse, and a distilled water rinse. Adequate time will be allowed for solvent evaporation before equipment reuse.

SECTION 8

SCHEDULE AND CERTIFICATION FOR CLOSURE

8.1 PROPOSED SCHEDULE FOR CLOSURE ACTIVITIES

Table 8.1 presents the schedule for the implementation of this closure plan. Each of the tasks is considered a major activity, and the Ohio EPA will be notified at least 5 days prior to initiating each task except for planned quarterly groundwater sampling. The engineer of record for the project will visit the site during approximately the 20-, 60- and 95-percent completion points of the installation and testing of both the source area soil remediation and groundwater amendment systems; and, if necessary, during the implementation of pre-closure contingency actions.

Time has been allowed in the schedule for the review and approval of all permit applications by-~~BUSTR~~, Ohio EPA, and other appropriate regulatory agencies. The AFBCA anticipates requesting site closure from Ohio EPA by the end of the year 2000; however, scheduled implementation of remedial action and site closure rely on timely review and approval of required tasks.

8.2 CERTIFICATION OF CLOSURE

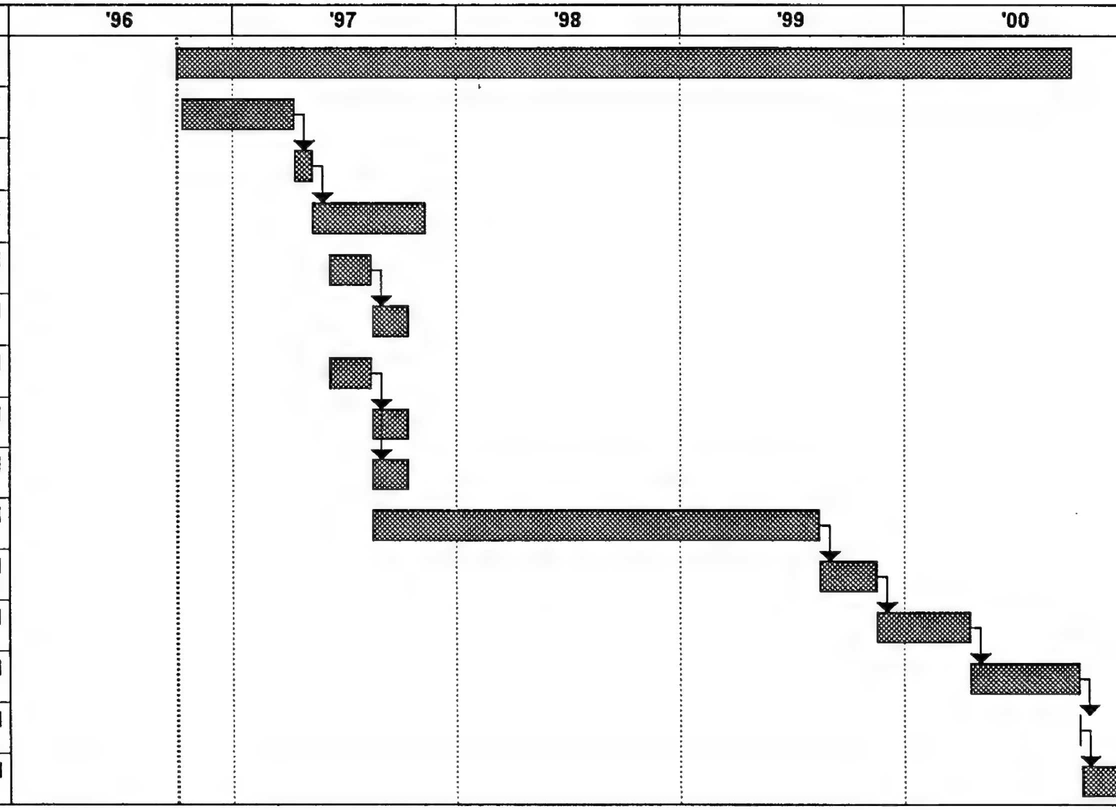
Rickenbacker ANGB will submit certification of closure to the Director of the Central District Office of the OEPA, and to the Regional administrator of the USEPA. The certification will be signed by an agent of the owner/operator and by an independent, qualified, Ohio-registered professional engineer.

In accordance with Ohio Revised Code, OAC 3745-50-42(D), the signatories to the certification of closure will make the following certification:

> ***"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.***

Figure 8.1
Schedule for Implementation of Interim Action and Closure of the Former HWSA
Rickenbacker ANGB, Ohio

Task Name	Start	Finish	Duration
Quarterly Groundwater Monitoring	10/2/96	9/30/00	1046d
Review/Approval of Amended Closure/Post Closure Plan	10/11/96	4/11/97	131d
Installation of Additional Monitoring Wells	4/14/97	5/12/97	21d
Preliminary Evaluation of Health Based Performance Requirements	5/13/97	11/11/97	131d
Installation/Testing of Source Area Soil Remediation System	6/9/97	8/15/97	50d
Regulatory Review of Test Results	8/18/97	10/14/97	42d
Installation/Testing of Groundwater Amendment System	6/9/97	8/15/97	50d
Regulatory Review of Test Results	8/18/97	10/14/97	42d
Regulatory Review/Approval of Final Design,As-Builts, and O&M Inf	8/18/97	10/14/97	42d
Operation of Approved Interim Remedial Systems	8/18/97	8/15/99	521d
Evaluation of Remedial Progress	8/16/99	11/16/99	67d
Regulatory Review & Approval	11/17/99	4/17/00	110d
Implementation of Contingency Actions, if necessary	4/18/00	10/12/00	129d
Final Closure Certification	10/13/00	10/13/00	1d
Post - Closure Activities (30 years) or per permit	10/16/00	10/16/30	7828d



Project:
Date: Wed 10/2/96

Task | Progress | Milestone | Summary | Rolled Up Task | Rolled Up Milestone | Rolled Up Progress

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Duration is calculated by a 5 day work week

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The certification will be submitted to the OEPA and USEPA within 60 days of completion of closure activities, via registered mail. The certification will include a report detailing the closure activities. These activities consist of pre-closure sampling, UST removal, post-removal sampling, groundwater remediation system design and construction, building decontamination and removal, cover construction, and post-closure care. The report will also document that the hazardous waste storage area has been closed in accordance with the Specifications of the approved Closure Plan. Additionally, this document will incorporate all laboratory records and correspondence regarding the closure activity after the OEPA approval.

SECTION 9

POST-CLOSURE PLAN

The following plan summarizes activities to be completed at the site during the post-closure life of the HWSA. The post-closure life of the HWSA may last up to 30 years unless approval of a shorter post-closure care period is granted by the Ohio EPA.

Activities to be conducted during the post-closure period of the facility include post-closure notices, groundwater monitoring, remediation system monitoring and maintenance, site inspection and maintenance, and periodic reporting and amendment of the Post-Closure Plan, if necessary.

9.1 ACCESS CONTROL

During closure activities, the site will be secured with a chain-link fence, with padlocked gates to limit access in compliance with OAC 3745-68-9. The fence will be removed prior to construction of the taxiway or implementation of contingency actions, if necessary. Limiting access to the site will be unnecessary following construction of the taxiway.

9.2 SITE SURVEY

The location and dimensions of the fenced area (HWSA) will be determined by a registered professional surveyor with reference to permanently installed and protected onsite benchmarks. The survey data will be used to prepare and maintain a survey plat of the HWSA, which will be kept on the Base.9.3 Amendment of the Post-Closure Plan

9.3 AMENDMENT OF THE POST-CLOSURE PLAN

Whenever changes in the operating plans or facility design affect the post-closure plan, or events occur during the post-closure life of the facility, including partial or final closure, the post-closure plan will be modified by the procedures established in OAC 3745-66-18.

9.4 POST-CLOSURE FIELD ACTIVITIES

Many of the activities to be completed as a part of the post-closure plan will be field-related activities. These activities are described in detail below.

A groundwater monitoring system, in accordance with OAC 3745-65-90 (D), will be implemented at the site during closure activities and remain in use throughout the

duration of the post-closure life of the facility. This system, which will comply with OAC 3745-65-91 (A, B, C) and 3745-65-92 (A, E) is described in greater detail below.

9.4.1 Monitoring Well Installation

Nineteen existing monitoring wells or points currently are used to conduct quarterly monitoring at the site (refer to Figure 4.1). These sampling locations have been used to define the nature and extent of contamination at the site prior to closure activities. However, additional sampling points will be required to monitor the performance of the groundwater oxygenation system and to confirm the downgradient extent of chlorinated contamination in groundwater.

A total of 8 additional wells (3 shallow and 5 deep) will be installed and sampled as part of closure and post-closure activities. Three additional shallow/deep well clusters will be installed in the vicinity of ESMP-17s to assess the extent of dissolved contamination, and to monitor the performance of the groundwater oxygenation system. A deep well will be installed in the vicinity of ESMP-2, ESMP-3, and ESMP-4 to monitor dissolved chlorinated compounds. Finally, a deep well will be installed in the vicinity of ESMP-13, ESMP-14, and ESMP-15 to monitor the ongoing transformation of TCE to DCE to vinyl chloride. These wells will be used to supplement four existing wells (MW-4, MW-6, MW-8 AND MW-12) during closure and post-closure activities. Ongoing monitoring of those 15 sampling locations currently used to complete quarterly groundwater monitoring also may be sampled, as needed.

A total of 12 permanent monitoring wells will be sampled as a part of the post-closure activities. The locations of existing and proposed new wells to be monitored during post-closure activities are shown on Figure 9.1. These wells will be drilled to depths of approximately 19 feet bgs, screened across the deeper portions of the shallow aquifer, and completed as described in OAC 3745-65-91 (C). These wells will be sampled using methods described in Section 6. The purpose of these wells is to monitor site-related contamination over time, and to evaluate the effectiveness of the implemented closure activities.

9.4.2 Groundwater Monitoring

The 12 wells comprising the long-term monitoring network **to be used during post-closure monitoring (Figure 9.1)** will be sampled quarterly for the parameters listed in Table 6.1. Results of these groundwater monitoring activities will be submitted to the OEPA in an annual report as required by OAC 3745-65-93. When the implemented closure activities have effectively reduced residual contaminant concentrations to levels that no longer pose an unacceptable risk to potential receptors, given the planned use of the site, the post-closure plan will be amended and a petition for a risk-based closure will be submitted.

9.4.3 Sampling and Analysis

During closure activities, g~~G~~roundwater samples will be collected from **the** 19 existing wells **currently included in the quarterly monitoring program (Figure 4.1)**~~quarterly during the closure activities~~. Following the installation of the additional

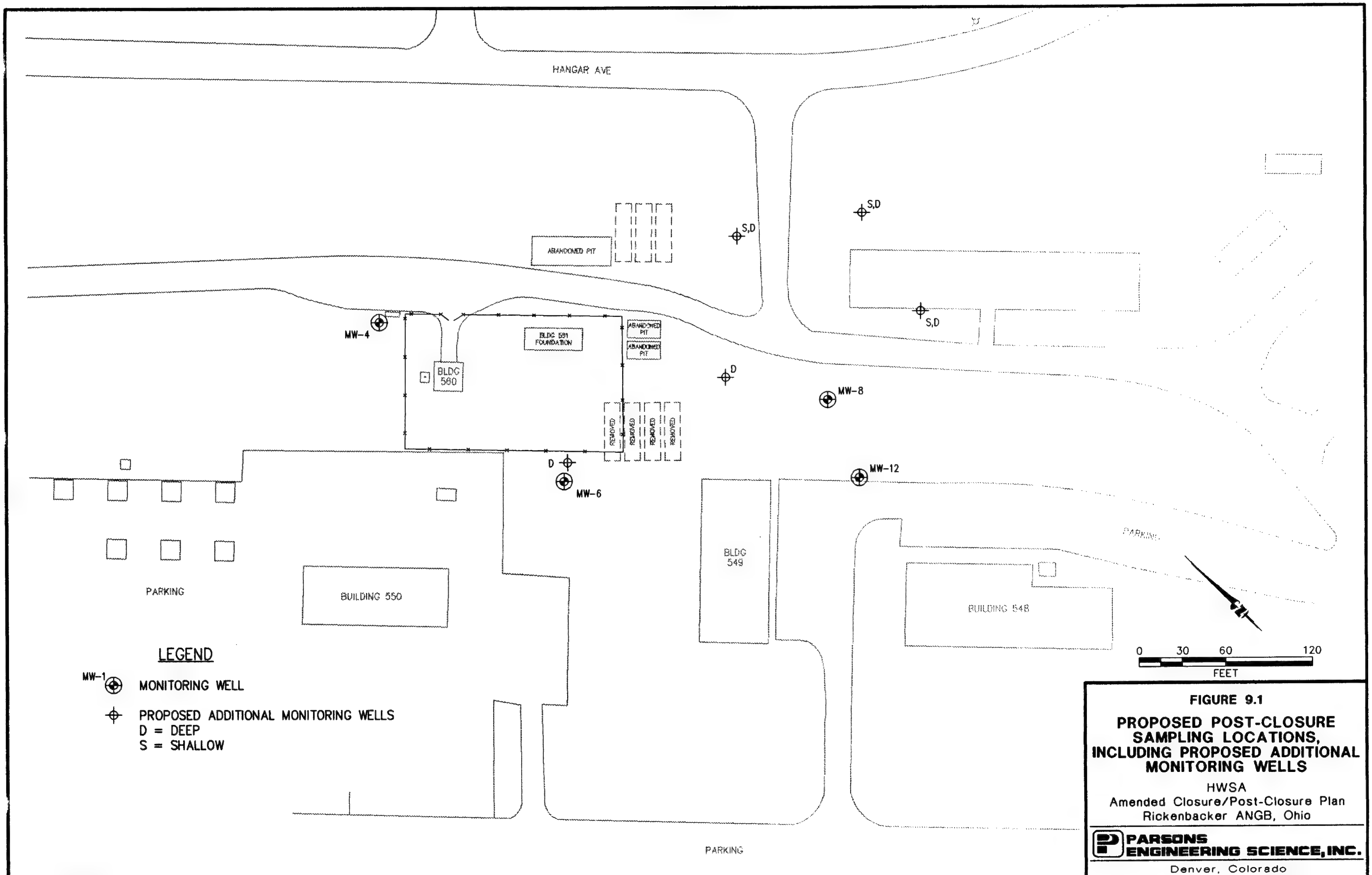

FIGURE 9.1

PROPOSED POST-CLOSURE SAMPLING LOCATIONS, INCLUDING PROPOSED ADDITIONAL MONITORING WELLS

HWSA
Amended Closure/Post-Closure Plan
Rickenbacker ANGB, Ohio

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

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8 wells, **one assessment sampling event will be performed at these wells and the original 19 wells. After closure of the site, quarterly sampling will be performed at the 12 wells shown on Figure 9.1 as part of post-closure monitoring**~~groundwater samples will be collected quarterly from those 8 wells and 4 previously installed wells as a part of the post-closure activities~~. All samples collected will be analyzed for parameters described in Table 6.1 using the methods described in Section 6. Samples will be collected and groundwater elevations will be determined.

9.4.4 System Inspection and Maintenance

Inspection and maintenance of all closure systems will be conducted concurrently with the quarterly sampling activities or as specified by system-specific operation and maintenance schedules. The inspection program will be recorded in a dedicated field book.

For the soil remediation system (whether passive or air injection), system inspections may be required about every month to evaluate performance. The following activities will typically be performed during a system check:

- Record air injection pressures and flow rates for each of the injection wells, if applicable;
- Measure injection blower operating temperature and inlet vacuum, if applicable;
- Assess the condition of the air inlet filter element and replace as necessary;
- Measure DO content in specified monitoring points; and
- Note any unusual operating characteristics (e.g., clogged lines, tripped breakers, or damaged vent well).

All maintenance activities will be recorded on a checklist and will become part of the site record.

In addition to the monitoring described above, *in situ* respiration and radius of influence tests should be performed annually at all vent wells (VWs) and at the discrete vapor monitoring points (MPs) at the site. Soil gas samples collected from these locations will be analyzed for VOCS. This testing and sampling will be used to assess remedial progress and to assure that biodegradation is continuing in accordance with the bioventing technical protocol (Hinchee *et al.*, 1992). If, at the end of the 1 or 2 years of operation, it appears that the majority of the VOC contamination at the site has been biodegraded based on respiration rates and soil gas samples, compliance soil samples will be collected. Samples will be analyzed for VOCs and SVOCs using USEPA methods. Soil samples will be compared to available site data to determine if contaminant levels have been remediated to levels that reduce potentially unacceptable risks.

For the groundwater oxygenation system, system inspections ideally should be performed every other week. the following activities will typically be performed during a system check:

- Record air injection pressure or check chemical addition rates;
- Measure the injection blower flow rate and operating temperature, if appropriate;
- Assess the condition of the air inlet filter elements and/or chemical oxidants and replace as necessary; and
- Note any unusual operating characteristics (e.g., clogged lines, tripped breakers, ripped chemical sacks).

All maintenance activities will be recorded on a checklist and will become part of the site record. In addition to field monitoring, quantitative testing of system performance will be completed ~~semi~~annually. These tests will be used to track progress in soil gas, soil, and groundwater toward *in situ* remediation. The following data should be collected during these testing events:

- Dissolved oxygen levels in the groundwater at various depths upgradient and downgradient from the system;
- Soil gas TVH concentrations before and after periodic system shut down; and
- Soil gas oxygen and carbon dioxide during a short-term respiration test.

These results will be used to determine contaminant removal rates and estimated treatment time. In addition, *in situ* respiration and oxygen radius-of-influence tests will be performed ~~semi~~annually at the site. This testing and sampling will be used to assess remedial progress and to assure that biodegradation is continuing. When **1-year**~~6-month~~ sampling results indicate that remediation is progressing as planned or asymptotic treatment levels have been attained, the system will be deactivated.

For the groundwater monitoring network, the inspection program will consist of checking each well for the following:

- Damaged protective casings;
- Damaged well casings;
- Missing or damaged well covers, caps, or locks;
- Presence of foreign objects in wells;
- Heaving of the wells;
- Damaged concrete pads;
- Subsidence of the wells;

- Silting of the wells; and

- Other signs of unauthorized use, abuse, vandalism, or deterioration.

If any of the above circumstances are observed, they will be noted in the dedicated field log book. The missing or damaged items will be repaired or replaced within 30 days, as appropriate. A record of any observations and repair/replacement activities will be included in the annual report.

9.4.5 Site Inspection and Maintenance

During each of the quarterly groundwater monitoring events, the site will be inspected and regular maintenance and repair activities will be completed. The following items will be inspected for damage due to use, abuse, wear, vandalism, or weathering:

- The fence, gate, and padlocks;

- The permanently installed benchmarks;

- The cover and drain system; and

- The site building.

If damage to any of these items is noted during the quarterly inspections, the damaged items will be immediately repaired or replaced. All damage and repair or maintenance actions will be noted in a field logbook and in the annual report to the Ohio EPA.

9.5 POST-CLOSURE NOTICES

9.5.1 Annual Groundwater Monitoring System Reports

Groundwater sampling reports will be submitted to the Ohio EPA annually during **closure activities and** the post-closure life of the facility. These reports will include the following information:

- Results of site inspection and maintenance activities;

- Groundwater elevation data;

- An evaluation of the groundwater surface elevations;

- Results of groundwater analyses;

- An evaluation of the analytical results;

- A determination of the rate and extent of contaminant migration; and

- Any other pertinent data or information.

9.5.2 Record of Hazardous Waste Disposal

As stipulated in OAC 3745-66-19, a record of the type, location, and quantity of hazardous wastes disposed of at the site will be submitted to the Ohio EPA and the local zoning authority no later than 60 days after the certification of closure.

9.5.3 Deed Restriction Notation and Certification

A notation will be recorded on the deed to the facility property in accordance with OAC 3745-66-19. A certification stating that the above-described notation was made and a copy of the document in which the notation was placed will be submitted to the director within sixty days of certification of closure.

9.5.4 Post-Closure Certification

A certification stating that the post-closure care period for the facility was performed in accordance with the specifications in the approved post closure plan will be submitted, by registered mail, to the **D**~~d~~irector **of the Central District Office of the OEPA, and to the Regional Administrator of the USEPA** within 60 days of the completion of the established post-closure period. This certification will be signed by an agent of the owner/operator and by an independent, qualified, Ohio-registered professional engineer. This certification will include the exact wording found in OAC 3745-50-42 (D), which states:

> *"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate information submitted. Based on my inquiry of the person or persons that manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."*

The certification will include a report detailing the closure activities. These activities consist of pre-closure sampling, UST removal, post-removal sampling, groundwater remediation system design and construction, if required, building decontamination and removal, cover construction, and post-closure care. The report will also document that the former HWSA has been closed in accordance with the specifications of the approved closure plan. Additionally, this document will incorporate all laboratory records and correspondence regarding the closure activity after the OEPA approval.

9.5.5 Survey Plat

A survey plat of the facility will be submitted to the Ohio EPA and the local zoning authority no later than the submission of the certification of closure. The survey plat will contain a note, prominently displayed, that states the obligation of the owner/operator to restrict disturbance of the facility in accordance with OAC 3745-66-10 to 3745-66-20.

9.6 POST-CLOSURE CONTACT

The post-closure contact for the referenced site is:

Mr. Alan Friedstrom
AFBCA/DA Rickenbacker~~AFBDA/MWR~~
7556 South Perimeter Road~~Building 548~~
Columbus, OH 43217-5910~~Rickenbacker ANGB, Ohio 43217-5001~~
Telephone: (614) 492-**8065 Ext. 134**~~673~~

SECTION 10

COST ESTIMATES FOR CLOSURE

Rickenbacker Air National Guard Base is exempt from filing a closure cost estimate (40 CFR 265.142 and .143) because it is owned and operated by the federal government. However, preliminary cost estimates have been provided to support potential subsequent decisions regarding the need for contingency actions at the HWSA. Tables 10.1 and 10.2 provide cost estimates for proposed closure activities and potential high-cost contingency actions, respectively. estimates include basic costs that exist for both approaches, such as groundwater monitoring, closure permitting and well installation. Estimates do not include costs for any post-closure activities, such as quarterly groundwater sampling, which may be required by the Ohio EPA. Costs for the decontamination of building 560 and the removal of the USTs are not included in these estimates.

The proposed closure approach as prescribed in this report includes implementation of several tasks, including engineered remediation. The following tasks represent activities that were not originally scoped in previous versions of this plan:

- Installation/testing of soil remediation and groundwater oxygenation systems;
- Installation of a total of 8 additional wells;
- One time sampling of 20 additional wells during scheduled quarterly groundwater sampling;
- Operation and maintenance of soil and groundwater remediation systems for two years; and
- Compliance soil sampling in the year 2000.

TABLE 10.1
COST ESTIMATES FOR PROPOSED CLOSURE ACTIONS
HAZARDOUS WASTE STORAGE AREA
AMENDED CLOSURE/POST-CLOSURE PLAN
RICKENBACKER ANGB,OHIO

	More Passive Approaches	More Engineered Approaches
Capital Costs		
Installation of 8 new wells to confirm nature and extent of contamination, and monitor remedial progress	$22,400	$22,400
Initial sampling of all wells (31 existing and 8 new)	$31,100	$31,100
Preliminary health-based performance evaluation with regulatory support	$56,000	$56,000
Installation and testing		
Passive venting system	$15,000	
Air injection bioventing system		$48,000
Installation and testing of interim groundwater remedial system to oxygenate leading edge of plume		
Passive addition of chemical oxidant (6 wells)	$30,000	
Air sparging with 4 wells		$33,660
Compliance soil sampling	$11,700	$11,700
Closure Permitting	$72,000	$72,000
Operation, Maintenance and Monitoring Costs (Annual)		
Quarterly Monitoring of 19 existing and 8 new wells (4 years)*	$88,440	$88,440
Soil gas monitoring (2 years)	$13,540	$13,540
Operate and Maintain soil remediation system (2 years)	$2,000	$13,200
Operate and Maintain groundwater remediation system (2 years)	$4,000	$13,200
Present Worth of Remedial Actions	$568,310	$641,894

Present worth calculations based on a discount factor of 7 percent.
* Cost does not include any post closure activities

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TABLE 10.2
COST ESTIMATES FOR CONTINGENCY ACTIONS
HAZARDOUS WASTE STORAGE AREA
AMENDED CLOSURE/POST-CLOSURE PLAN
RICKENBACKER ANGB,OHIO

Capital Costs	
Installation of 8 new wells to confirm nature and extent, and monitor remedial progress	$22,400
Initial sampling of all wells (31 existing and 8 new)	$31,100
Preliminary health-based performance evaluation with regulatory support	$56,000
Installation of onsite extraction system (4 extraction wells)	$60,000
Installation of onsite groundwater treatment system	$885,000
Design and Installation of cover (120' x 240')	$75,000
Closure Permitting	$72,000
Operation, Maintenance and Monitoring Costs (Annual)	
Quarterly Monitoring of 19 existing and 8 new wells (4 years)*	$88,440
Operate and Maintain onsite groundwater extraction system (2years)	$44,100
Operate and Maintain onsite groundwater treatment system (2 years)	$570,900
Present Worth of Remedial Actions	$2,612,693

Present worth calculations based on a discount factor of 7 percent.
* Cost does not include any post closure activities

SECTION 11

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APPENDIX A

SUMMARY OF ANALYTICAL DATA, 1988-1990

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – SOIL

SAMPLE #	GRID #	DEPTH	IN/OUT	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUALIFIER	UNITS	DETECTION LIMIT
SU-19	A-2	0-2	OUT	SURFACE SOIL SAMPLE	SV	Anthracene	130	J	ug/kg	330
SU-19	A-2	0-2	OUT	SURFACE SOIL SAMPLE	SV	Fluoranthene	1500		ug/kg	330
SU-19	A-2	0-2	OUT	SURFACE SOIL SAMPLE	SV	Pyrene	1500		ug/kg	330
SU-19	A-2	0-2	OUT	SURFACE SOIL SAMPLE	SV	Benzo(a)Anthracene	740		ug/kg	330
SU-19	A-2	0-2	OUT	SURFACE SOIL SAMPLE	SV	Chrysene	770		ug/kg	330
SU-19	A-2	0-2	OUT	SURFACE SOIL SAMPLE	SV	Benzo(b)Fluoranthene	750		ug/kg	330
SU-19	A-2	0-2	OUT	SURFACE SOIL SAMPLE	SV	Benzo(k)Fluoranthene	530		ug/kg	330
SU-19	A-2	0-2	OUT	SURFACE SOIL SAMPLE	SV	Benzo(a)Pyrene	650		ug/kg	330
SU-19	A-2	0-2	OUT	SURFACE SOIL SAMPLE	SV	Indeno(1,2,3-cd)Pyrene	440		ug/kg	330
SU-19	A-2	0-2	OUT	SURFACE SOIL SAMPLE	SV	Benzo(g,h,i)Perylene	300		ug/kg	330
SU-19	A-2	0-2	OUT	SURFACE SOIL SAMPLE	M	Antimony	4.6	UNJ	mg/kg	6
SU-19	A-2	0-2	OUT	SURFACE SOIL SAMPLE	M	Arsenic	9.8	BNJ	mg/kg	1
SU-19	A-2	0-2	OUT	SURFACE SOIL SAMPLE	M	Beryllium	0.45	B	mg/kg	0.5
SU-19	A-2	0-2	OUT	SURFACE SOIL SAMPLE	M	Cadmium	0.68		mg/kg	0.5
SU-19	A-2	0-2	OUT	SURFACE SOIL SAMPLE	M	Chromium	14.4	NJ	mg/kg	1
SU-19	A-2	0-2	OUT	SURFACE SOIL SAMPLE	M	Copper	15.8	*	mg/kg	2.5
SU-19	A-2	0-2	OUT	SURFACE SOIL SAMPLE	M	Lead	110		mg/kg	0.3
SU-19	A-2	0-2	OUT	SURFACE SOIL SAMPLE	M	Mercury	0.099	B	mg/kg	0.1
SU-19	A-2	0-2	OUT	SURFACE SOIL SAMPLE	M	Nickel	14.1		mg/kg	4
SU-19	A-2	0-2	OUT	SURFACE SOIL SAMPLE	M	Selenium	0.2	U	mg/kg	0.5
SU-19	A-2	0-2	OUT	SURFACE SOIL SAMPLE	M	Silver	0.75	U	mg/kg	1
SU-19	A-2	0-2	OUT	SURFACE SOIL SAMPLE	M	Thallium	0.53	UNWJ	mg/kg	1
SU-19	A-2	0-2	OUT	SURFACE SOIL SAMPLE	M	Zinc	98.8	NJ	mg/kg	2
SU-20	A-3	0-2	OUT	SURFACE SOIL SAMPLE	SV	ALL SEMI-VOLATILES	ND	NA	ug/kg	NA
SU-20	A-3	0-2	OUT	SURFACE SOIL SAMPLE	M	Antimony	4	UNJ	mg/kg	6
SU-20	A-3	0-2	OUT	SURFACE SOIL SAMPLE	M	Arsenic	13.1	BNJ	mg/kg	1
SU-20	A-3	0-2	OUT	SURFACE SOIL SAMPLE	M	Beryllium	1.0	NJ	mg/kg	0.5
SU-20	A-3	0-2	OUT	SURFACE SOIL SAMPLE	M	Cadmium	0.19	U	mg/kg	0.5
SU-20	A-3	0-2	OUT	SURFACE SOIL SAMPLE	M	Chromium	9.1	NJ	mg/kg	1
SU-20	A-3	0-2	OUT	SURFACE SOIL SAMPLE	M	Copper	15.3	*	mg/kg	2.5
SU-20	A-3	0-2	OUT	SURFACE SOIL SAMPLE	M	Lead	22.9		mg/kg	0.3
SU-20	A-3	0-2	OUT	SURFACE SOIL SAMPLE	M	Mercury	0.082	BU	mg/kg	0.1
SU-20	A-3	0-2	OUT	SURFACE SOIL SAMPLE	M	Nickel	15.2		mg/kg	4
SU-20	A-3	0-2	OUT	SURFACE SOIL SAMPLE	M	Selenium	0.2	BW	mg/kg	0.5
SU-20	A-3	0-2	OUT	SURFACE SOIL SAMPLE	M	Silver	0.66	U	mg/kg	1
SU-20	A-3	0-2	OUT	SURFACE SOIL SAMPLE	M	Thallium	0.47	UNWJ	mg/kg	1
SU-20	A-3	0-2	OUT	SURFACE SOIL SAMPLE	M	Zinc	71	NJ	mg/kg	2

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – SOIL

SAMPLE #	GRID #	DEPTH	IN/OUT	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUALIFIER	UNITS	DETECTION LIMIT
SU-21	A-4	0-2	OUT	SURFACE SOIL SAMPLE	SV	ALL SEMI-VOLATILES	ND	NA	ug/kg	NA
SU-21	A-4	0-2	OUT	SURFACE SOIL SAMPLE	M	Antimony	4.8	UNJ	mg/kg	6
SU-21	A-4	0-2	OUT	SURFACE SOIL SAMPLE	M	Arsenic	6.8	BNJ	mg/kg	1
SU-21	A-4	0-2	OUT	SURFACE SOIL SAMPLE	M	Beryllium	0.36	B	mg/kg	0.5
SU-21	A-4	0-2	OUT	SURFACE SOIL SAMPLE	M	Cadmium	0.24	B	mg/kg	0.5
SU-21	A-4	0-2	OUT	SURFACE SOIL SAMPLE	M	Chromium	3.6	NJ	mg/kg	1
SU-21	A-4	0-2	OUT	SURFACE SOIL SAMPLE	M	Copper	11	*	mg/kg	2.5
SU-21	A-4	0-2	OUT	SURFACE SOIL SAMPLE	M	Lead	25.7		mg/kg	0.3
SU-21	A-4	0-2	OUT	SURFACE SOIL SAMPLE	M	Mercury	0.06	U	mg/kg	0.1
SU-21	A-4	0-2	OUT	SURFACE SOIL SAMPLE	M	Nickel	11.9		mg/kg	4
SU-21	A-4	0-2	OUT	SURFACE SOIL SAMPLE	M	Selenium	0.23	BW	mg/kg	0.5
SU-21	A-4	0-2	OUT	SURFACE SOIL SAMPLE	M	Silver	0.78	U	mg/kg	1
SU-21	A-4	0-2	OUT	SURFACE SOIL SAMPLE	M	Thallium	0.53	UNWJ	mg/kg	1
SU-21	A-4	0-2	OUT	SURFACE SOIL SAMPLE	M	Zinc	34.4	NJ	mg/kg	2
SU-22	A-5	0-2	OUT	SURFACE SOIL SAMPLE	SV	Phenanthrene	290	J	ug/kg	330
SU-22	A-5	0-2	OUT	SURFACE SOIL SAMPLE	SV	Fluoranthene	600		ug/kg	330
SU-22	A-5	0-2	OUT	SURFACE SOIL SAMPLE	SV	Pyrene	570		ug/kg	330
SU-22	A-5	0-2	OUT	SURFACE SOIL SAMPLE	SV	Benzo(a)Anthracene	200	J	ug/kg	330
SU-22	A-5	0-2	OUT	SURFACE SOIL SAMPLE	SV	Chrysene	320	J	ug/kg	330
SU-22	A-5	0-2	OUT	SURFACE SOIL SAMPLE	SV	Benzo(b)Fluoranthene	350	J	ug/kg	330
SU-22	A-5	0-2	OUT	SURFACE SOIL SAMPLE	SV	Benzo(a)Pyrene	250	J	ug/kg	330
SU-22	A-5	0-2	OUT	SURFACE SOIL SAMPLE	SV	Indeno(1,2,3-cd)Pyrene	100	J	ug/kg	330
SU-22	A-5	0-2	OUT	SURFACE SOIL SAMPLE	SV	Benzo(g,h,i)Perylene	160	J	ug/kg	330
SU-22	A-5	0-2	OUT	SURFACE SOIL SAMPLE	M	Antimony	4.8	UNJ	mg/kg	6
SU-22	A-5	0-2	OUT	SURFACE SOIL SAMPLE	M	Arsenic	6.4	BNJ	mg/kg	1
SU-22	A-5	0-2	OUT	SURFACE SOIL SAMPLE	M	Beryllium	0.6		mg/kg	0.5
SU-22	A-5	0-2	OUT	SURFACE SOIL SAMPLE	M	Cadmium	0.24	B	mg/kg	0.5
SU-22	A-5	0-2	OUT	SURFACE SOIL SAMPLE	M	Chromium	8.8	NJ	mg/kg	1
SU-22	A-5	0-2	OUT	SURFACE SOIL SAMPLE	M	Copper	12.8	*	mg/kg	2.5
SU-22	A-5	0-2	OUT	SURFACE SOIL SAMPLE	M	Lead	43.8		mg/kg	0.3
SU-22	A-5	0-2	OUT	SURFACE SOIL SAMPLE	M	Mercury	0.053	U	mg/kg	0.1
SU-22	A-5	0-2	OUT	SURFACE SOIL SAMPLE	M	Nickel	12.2		mg/kg	4
SU-22	A-5	0-2	OUT	SURFACE SOIL SAMPLE	M	Selenium	0.21	UW	mg/kg	0.5
SU-22	A-5	0-2	OUT	SURFACE SOIL SAMPLE	M	Silver	0.79	U	mg/kg	1
SU-22	A-5	0-2	OUT	SURFACE SOIL SAMPLE	M	Thallium	0.54	UNWJ	mg/kg	1
SU-22	A-5	0-2	OUT	SURFACE SOIL SAMPLE	M	Zinc	60.4	NJ	mg/kg	2

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – SOIL

SAMPLE #	GRID #	DEPTH	IN/OUT	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUALIFIER	UNITS	DETECTION LIMIT
SU-23	A-6	0-2	OUT	SURFACE SOIL SAMPLE	SV	Phenanthrene	200	J	ug/kg	330
SU-23	A-6	0-2	OUT	SURFACE SOIL SAMPLE	SV	Fluoranthene	590		ug/kg	330
SU-23	A-6	0-2	OUT	SURFACE SOIL SAMPLE	SV	Pyrene	570	J	ug/kg	330
SU-23	A-6	0-2	OUT	SURFACE SOIL SAMPLE	SV	Benzo(a)Anthracene	260	J	ug/kg	330
SU-23	A-6	0-2	OUT	SURFACE SOIL SAMPLE	SV	Chrysene	290	J	ug/kg	330
SU-23	A-6	0-2	OUT	SURFACE SOIL SAMPLE	SV	Benzo(b)Fluoranthene	520		ug/kg	330
SU-23	A-6	0-2	OUT	SURFACE SOIL SAMPLE	SV	Benzo(a)Pyrene	260	J	ug/kg	330
SU-23	A-6	0-2	OUT	SURFACE SOIL SAMPLE	M	Antimony	4.8	UNJ	mg/kg	6
SU-23	A-6	0-2	OUT	SURFACE SOIL SAMPLE	M	Arsenic	10.8	BNJ	mg/kg	1
SU-23	A-6	0-2	OUT	SURFACE SOIL SAMPLE	M	Beryllium	0.96		mg/kg	0.5
SU-23	A-6	0-2	OUT	SURFACE SOIL SAMPLE	M	Cadmium	0.23	U	mg/kg	0.5
SU-23	A-6	0-2	OUT	SURFACE SOIL SAMPLE	M	Chromium	14.7	NJ	mg/kg	1
SU-23	A-6	0-2	OUT	SURFACE SOIL SAMPLE	M	Copper	18.6	*	mg/kg	2.5
SU-23	A-6	0-2	OUT	SURFACE SOIL SAMPLE	M	Lead	52.9		mg/kg	0.3
SU-23	A-6	0-2	OUT	SURFACE SOIL SAMPLE	M	Mercury	0.09	B	mg/kg	0.1
SU-23	A-6	0-2	OUT	SURFACE SOIL SAMPLE	M	Nickel	21.4		mg/kg	4
SU-23	A-6	0-2	OUT	SURFACE SOIL SAMPLE	M	Selenium	0.2	U	mg/kg	0.5
SU-23	A-6	0-2	OUT	SURFACE SOIL SAMPLE	M	Silver	0.79	U	mg/kg	1
SU-23	A-6	0-2	OUT	SURFACE SOIL SAMPLE	M	Thallium	0.54	UNWJ	mg/kg	1
SU-23	A-6	0-2	OUT	SURFACE SOIL SAMPLE	M	Zinc	106	NJ	mg/kg	2
SU-24	A-7	0-2	OUT	SURFACE SOIL SAMPLE	SV	Fluoranthene	140	J	ug/kg	330
SU-24	A-7	0-2	OUT	SURFACE SOIL SAMPLE	SV	Pyrene	150	J	ug/kg	330
SU-24	A-7	0-2	OUT	SURFACE SOIL SAMPLE	M	Antimony	4.5	UNJ	mg/kg	6
SU-24	A-7	0-2	OUT	SURFACE SOIL SAMPLE	M	Arsenic	15.2	NJ	mg/kg	1
SU-24	A-7	0-2	OUT	SURFACE SOIL SAMPLE	M	Beryllium	0.67		mg/kg	0.5
SU-24	A-7	0-2	OUT	SURFACE SOIL SAMPLE	M	Cadmium	0.22	B	mg/kg	0.5
SU-24	A-7	0-2	OUT	SURFACE SOIL SAMPLE	M	Chromium	14.1	NJ	mg/kg	1
SU-24	A-7	0-2	OUT	SURFACE SOIL SAMPLE	M	Copper	17.8	*	mg/kg	2.5
SU-24	A-7	0-2	OUT	SURFACE SOIL SAMPLE	M	Lead	68.4		mg/kg	0.3
SU-24	A-7	0-2	OUT	SURFACE SOIL SAMPLE	M	Mercury	0.056	U	mg/kg	0.1
SU-24	A-7	0-2	OUT	SURFACE SOIL SAMPLE	M	Nickel	24.1		mg/kg	4
SU-24	A-7	0-2	OUT	SURFACE SOIL SAMPLE	M	Selenium	0.18	UW	mg/kg	0.5
SU-24	A-7	0-2	OUT	SURFACE SOIL SAMPLE	M	Silver	0.74	U	mg/kg	1
SU-24	A-7	0-2	OUT	SURFACE SOIL SAMPLE	M	Thallium	0.46	UNWJ	mg/kg	1
SU-24	A-7	0-2	OUT	SURFACE SOIL SAMPLE	M	Zinc	95.7	NJ	mg/kg	2

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – SOIL

SAMPLE #	GRID #	DEPTH	IN/OUT	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUALIFIER	UNITS	DETECTION LIMIT
SU-25	B-2	0-2	IN	SURFACE SOIL SAMPLE	SV	Fluoranthene	150	J	ug/kg	330
SU-25	B-2	0-2	IN	SURFACE SOIL SAMPLE	SV	Pyrene	150	J	ug/kg	330
SU-25	B-2	0-2	IN	SURFACE SOIL SAMPLE	M	Antimony	3.8	UNJ	mg/kg	6
SU-25	B-2	0-2	IN	SURFACE SOIL SAMPLE	M	Arsenic	17.3		mg/kg	0.5
SU-25	B-2	0-2	IN	SURFACE SOIL SAMPLE	M	Beryllium	0.66		mg/kg	0.5
SU-25	B-2	0-2	IN	SURFACE SOIL SAMPLE	M	Cadmium	0.47		mg/kg	1
SU-25	B-2	0-2	IN	SURFACE SOIL SAMPLE	M	Chromium	14.5		mg/kg	2.5
SU-25	B-2	0-2	IN	SURFACE SOIL SAMPLE	M	Copper	23.3	NJ	mg/kg	0.3
SU-25	B-2	0-2	IN	SURFACE SOIL SAMPLE	M	Lead	22.4	N*J	mg/kg	0.1
SU-25	B-2	0-2	IN	SURFACE SOIL SAMPLE	M	Mercury	0.059	U	mg/kg	4
SU-25	B-2	0-2	IN	SURFACE SOIL SAMPLE	M	Nickel	24.4		mg/kg	0.5
SU-25	B-2	0-2	IN	SURFACE SOIL SAMPLE	M	Selenium	0.31	BW	mg/kg	1
SU-25	B-2	0-2	IN	SURFACE SOIL SAMPLE	M	Silver	0.62	U	mg/kg	1
SU-25	B-2	0-2	IN	SURFACE SOIL SAMPLE	M	Thallium	0.21	BNWJ	mg/kg	2
SU-25	B-2	0-2	IN	SURFACE SOIL SAMPLE	M	Zinc	84	NJ	mg/kg	2
SU-26	B-4	0-2	IN	SURFACE SOIL SAMPLE	SV	Phenanthrene	550		ug/kg	330
SU-26	B-4	0-2	IN	SURFACE SOIL SAMPLE	SV	Fluoranthene	1100		ug/kg	330
SU-26	B-4	0-2	IN	SURFACE SOIL SAMPLE	SV	Pyrene	1100		ug/kg	330
SU-26	B-4	0-2	IN	SURFACE SOIL SAMPLE	SV	Benzo(a)Anthracene	520		ug/kg	330
SU-26	B-4	0-2	IN	SURFACE SOIL SAMPLE	SV	Chrysene	560		ug/kg	330
SU-26	B-4	0-2	IN	SURFACE SOIL SAMPLE	SV	Benzo(b)Fluoranthene	1000		ug/kg	330
SU-26	B-4	0-2	IN	SURFACE SOIL SAMPLE	SV	Benzo(a)Pyrene	510		ug/kg	330
SU-26	B-4	0-2	IN	SURFACE SOIL SAMPLE	SV	Indeno(1,2,3-cd)Pyrene	330	J	ug/kg	330
SU-26	B-4	0-2	IN	SURFACE SOIL SAMPLE	SV	Benzo(g,h,i)Perylene	330	J	ug/kg	330
SU-26	B-4	0-2	IN	SURFACE SOIL SAMPLE	M	Antimony	4.9	UNJ	mg/kg	6
SU-26	B-4	0-2	IN	SURFACE SOIL SAMPLE	M	Arsenic	12.5	NJ	mg/kg	0.5
SU-26	B-4	0-2	IN	SURFACE SOIL SAMPLE	M	Beryllium	0.49	B	mg/kg	0.5
SU-26	B-4	0-2	IN	SURFACE SOIL SAMPLE	M	Cadmium	1.4		mg/kg	1
SU-26	B-4	0-2	IN	SURFACE SOIL SAMPLE	M	Chromium	18.6	N	mg/kg	1
SU-26	B-4	0-2	IN	SURFACE SOIL SAMPLE	M	Copper	31.6	*	mg/kg	2.5
SU-26	B-4	0-2	IN	SURFACE SOIL SAMPLE	M	Lead	90.7		mg/kg	0.3
SU-26	B-4	0-2	IN	SURFACE SOIL SAMPLE	M	Mercury	2.6	U	mg/kg	0.1
SU-26	B-4	0-2	IN	SURFACE SOIL SAMPLE	M	Nickel	20.2		mg/kg	4
SU-26	B-4	0-2	IN	SURFACE SOIL SAMPLE	M	Selenium	0.74	BW	mg/kg	0.5
SU-26	B-4	0-2	IN	SURFACE SOIL SAMPLE	M	Silver	7.2	U	mg/kg	1
SU-26	B-4	0-2	IN	SURFACE SOIL SAMPLE	M	Thallium	0.56	UNWJ	mg/kg	1
SU-26	B-4	0-2	IN	SURFACE SOIL SAMPLE	M	Zinc	203	NJ	mg/kg	2

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – SOIL

SAMPLE #	GRID #	DEPTH	IN/OUT	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUALIFIER	UNITS	DETECTION LIMIT
SU-27	B-4	0-2	IN	SURFACE SOIL SAMPLE	SV	ALL SEMI-VOLATILES	ND	NA	ug/kg	NA
SU-27	B-4	0-2	IN	SURFACE SOIL SAMPLE	M	Antimony	4.3	UNJ	mg/kg	6
SU-27	B-4	0-2	IN	SURFACE SOIL SAMPLE	M	Arsenic	14	NJ	mg/kg	0.5
SU-27	B-4	0-2	IN	SURFACE SOIL SAMPLE	M	Beryllium	0.65		mg/kg	0.5
SU-27	B-4	0-2	IN	SURFACE SOIL SAMPLE	M	Cadmium	0.2	U	mg/kg	1
SU-27	B-4	0-2	IN	SURFACE SOIL SAMPLE	M	Chromium	14.1	N	mg/kg	1
SU-27	B-4	0-2	IN	SURFACE SOIL SAMPLE	M	Copper	20.2	*	mg/kg	2.5
SU-27	B-4	0-2	IN	SURFACE SOIL SAMPLE	M	Lead	59.0		mg/kg	0.3
SU-27	B-4	0-2	IN	SURFACE SOIL SAMPLE	M	Mercury	0.052	U	mg/kg	0.1
SU-27	B-4	0-2	IN	SURFACE SOIL SAMPLE	M	Nickel	23.5		mg/kg	4
SU-27	B-4	0-2	IN	SURFACE SOIL SAMPLE	M	Selenium	0.26	B	mg/kg	0.5
SU-27	B-4	0-2	IN	SURFACE SOIL SAMPLE	M	Silver	0.71	U	mg/kg	1
SU-27	B-4	0-2	IN	SURFACE SOIL SAMPLE	M	Thallium	0.40	UNWJ	mg/kg	1
SU-27	B-4	0-2	IN	SURFACE SOIL SAMPLE	M	Zinc	89.3	NJ	mg/kg	2
SU-20	B-5	0-2	IN	SURFACE SOIL SAMPLE	SV	ALL SEMI-VOLATILES	ND	NA	ug/kg	NA
SU-20	B-5	0-2	IN	SURFACE SOIL SAMPLE	M	Antimony	4.0	UNJ	mg/kg	6
SU-20	B-5	0-2	IN	SURFACE SOIL SAMPLE	M	Arsenic	10.0	BNJ	mg/kg	0.5
SU-20	B-5	0-2	IN	SURFACE SOIL SAMPLE	M	Beryllium	0.60		mg/kg	0.5
SU-20	B-5	0-2	IN	SURFACE SOIL SAMPLE	M	Cadmium	0.22	U	mg/kg	1
SU-20	B-5	0-2	IN	SURFACE SOIL SAMPLE	M	Chromium	13.0	N	mg/kg	1
SU-20	B-5	0-2	IN	SURFACE SOIL SAMPLE	M	Copper	17.4	*	mg/kg	2.5
SU-20	B-5	0-2	IN	SURFACE SOIL SAMPLE	M	Lead	43.2		mg/kg	0.3
SU-20	B-5	0-2	IN	SURFACE SOIL SAMPLE	M	Mercury	0.064	U	mg/kg	0.1
SU-20	B-5	0-2	IN	SURFACE SOIL SAMPLE	M	Nickel	18.0		mg/kg	4
SU-20	B-5	0-2	IN	SURFACE SOIL SAMPLE	M	Selenium	0.40	B	mg/kg	0.5
SU-20	B-5	0-2	IN	SURFACE SOIL SAMPLE	M	Silver	0.75	U	mg/kg	1
SU-20	B-5	0-2	IN	SURFACE SOIL SAMPLE	M	Thallium	0.50	UNWJ	mg/kg	1
SU-20	B-5	0-2	IN	SURFACE SOIL SAMPLE	M	Zinc	95	NJ	mg/kg	2

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – SOIL

SAMPLE #	GRID #	DEPTH	IN/OUT	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUALIFIER	UNITS	DETECTION LIMIT
SU-29	B-6	0-2	IN	SURFACE SOIL SAMPLE	SV	Pyrene	260	J	ug/kg	330
SU-29	B-6	0-2	IN	SURFACE SOIL SAMPLE	SV	Fluoranthene	220	J	ug/kg	330
SU-29	B-6	0-2	IN	SURFACE SOIL SAMPLE	SV	Benzo(a)Anthracene	140	J	ug/kg	330
SU-29	B-6	0-2	IN	SURFACE SOIL SAMPLE	SV	Chrysene	160	J	ug/kg	330
SU-29	B-6	0-2	IN	SURFACE SOIL SAMPLE	SV	Benzo(b)Fluoranthene	160	J	ug/kg	330
SU-29	B-6	0-2	IN	SURFACE SOIL SAMPLE	SV	Benzo(k)Fluoranthene	130	J	ug/kg	330
SU-29	B-6	0-2	IN	SURFACE SOIL SAMPLE	SV	Benzo(a)Pyrene	140	J	ug/kg	330
SU-29	B-6	0-2	IN	SURFACE SOIL SAMPLE	M	Antimony	4.7	UNJ	mg/kg	6
SU-29	B-6	0-2	IN	SURFACE SOIL SAMPLE	M	Arsenic	11.9	NJ	mg/kg	0.5
SU-29	B-6	0-2	IN	SURFACE SOIL SAMPLE	M	Beryllium	0.93		mg/kg	0.5
SU-29	B-6	0-2	IN	SURFACE SOIL SAMPLE	M	Cadmium	0.22	U	mg/kg	1
SU-29	B-6	0-2	IN	SURFACE SOIL SAMPLE	M	Chromium	11.1	N	mg/kg	1
SU-29	B-6	0-2	IN	SURFACE SOIL SAMPLE	M	Copper	20.0	*	mg/kg	2.5
SU-29	B-6	0-2	IN	SURFACE SOIL SAMPLE	M	Lead	32.1		mg/kg	0.3
SU-29	B-6	0-2	IN	SURFACE SOIL SAMPLE	M	Mercury	0.050	U	mg/kg	0.1
SU-29	B-6	0-2	IN	SURFACE SOIL SAMPLE	M	Nickel	21.5		mg/kg	4
SU-29	B-6	0-2	IN	SURFACE SOIL SAMPLE	M	Selenium	0.34	BW	mg/kg	0.5
SU-29	B-6	0-2	IN	SURFACE SOIL SAMPLE	M	Silver	0.77	U	mg/kg	1
SU-29	B-6	0-2	IN	SURFACE SOIL SAMPLE	M	Thallium	0.49	UNW	mg/kg	1
SU-29	B-6	0-2	IN	SURFACE SOIL SAMPLE	M	Zinc	109	N	mg/kg	2

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – SOIL

SAMPLE #	GRID #	DEPTH	IN/OUT	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUALIFIER	UNITS	DETECTION LIMIT
SU-30	B-7	0-2	OUT	SURFACE SOIL SAMPLE	SV	Fluoranthene	170	J	ug/kg	330
SU-30	B-7	0-2	OUT	SURFACE SOIL SAMPLE	SV	Pyrene	210	J	ug/kg	330
SU-30	B-7	0-2	OUT	SURFACE SOIL SAMPLE	SV	Benzo(a)Anthracene	130	J	ug/kg	330
SU-30	B-7	0-2	OUT	SURFACE SOIL SAMPLE	SV	Chrysene	140	J	ug/kg	330
SU-30	B-7	0-2	OUT	SURFACE SOIL SAMPLE	SV	Benzo(b)Fluoranthene	220	J	ug/kg	330
SU-30	B-7	0-2	OUT	SURFACE SOIL SAMPLE	SV	Benzo(k)Fluoranthene	190	J	ug/kg	330
SU-30	B-7	0-2	OUT	SURFACE SOIL SAMPLE	SV	Benzo(a)Pyrene	230	J	ug/kg	330
SU-30	B-7	0-2	OUT	SURFACE SOIL SAMPLE	SV	Indeno(1,2,3-cd)Pyrene	200	J	ug/kg	330
SU-30	B-7	0-2	OUT	SURFACE SOIL SAMPLE	SV	Benzo(g,h,i)Perylene	220	J	ug/kg	330
SU-30	B-7	0-2	OUT	SURFACE SOIL SAMPLE	M	Antimony	4.9	UNJ	mg/kg	6
SU-30	B-7	0-2	OUT	SURFACE SOIL SAMPLE	M	Arsenic	8.6	BNJ	mg/kg	0.5
SU-30	B-7	0-2	OUT	SURFACE SOIL SAMPLE	M	Beryllium	0.49	B	mg/kg	0.5
SU-30	B-7	0-2	OUT	SURFACE SOIL SAMPLE	M	Cadmium	0.23	U	mg/kg	1
SU-30	B-7	0-2	OUT	SURFACE SOIL SAMPLE	M	Chromium	14.4	NJ	mg/kg	1
SU-30	B-7	0-2	OUT	SURFACE SOIL SAMPLE	M	Copper	14	*	mg/kg	2.5
SU-30	B-7	0-2	OUT	SURFACE SOIL SAMPLE	M	Lead	65.1		mg/kg	0.3
SU-30	B-7	0-2	OUT	SURFACE SOIL SAMPLE	M	Mercury	0.052	U	mg/kg	0.1
SU-30	B-7	0-2	OUT	SURFACE SOIL SAMPLE	M	Nickel	13.9	*	mg/kg	4
SU-30	B-7	0-2	OUT	SURFACE SOIL SAMPLE	M	Selenium	0.36	BW	mg/kg	0.5
SU-30	B-7	0-2	OUT	SURFACE SOIL SAMPLE	M	Silver	0.81	U	mg/kg	1
SU-30	B-7	0-2	OUT	SURFACE SOIL SAMPLE	M	Thallium	0.54	UNJW	mg/kg	1
SU-30	B-7	0-2	OUT	SURFACE SOIL SAMPLE	M	Zinc	76.3	NJ	mg/kg	2
SU-31	C-1	0-2	OUT	SURFACE SOIL SAMPLE	SV	ALL SEMI-VOLATILES	ND	NA	ug/kg	NA
SU-31	C-1	0-2	OUT	SURFACE SOIL SAMPLE	M	Antimony	5.3	UNJ	mg/kg	6
SU-31	C-1	0-2	OUT	SURFACE SOIL SAMPLE	M	Arsenic	6.9	BNWJ	mg/kg	0.5
SU-31	C-1	0-2	OUT	SURFACE SOIL SAMPLE	M	Beryllium	0.66		mg/kg	0.5
SU-31	C-1	0-2	OUT	SURFACE SOIL SAMPLE	M	Cadmium	0.53	B	mg/kg	1
SU-31	C-1	0-2	OUT	SURFACE SOIL SAMPLE	M	Chromium	12.8	NJ	mg/kg	1
SU-31	C-1	0-2	OUT	SURFACE SOIL SAMPLE	M	Copper	13	*	mg/kg	2.5
SU-31	C-1	0-2	OUT	SURFACE SOIL SAMPLE	M	Lead	40.8		mg/kg	0.3
SU-31	C-1	0-2	OUT	SURFACE SOIL SAMPLE	M	Mercury	0.064	U	mg/kg	0.1
SU-31	C-1	0-2	OUT	SURFACE SOIL SAMPLE	M	Nickel	16		mg/kg	4
SU-31	C-1	0-2	OUT	SURFACE SOIL SAMPLE	M	Selenium	0.59	B	mg/kg	0.5
SU-31	C-1	0-2	OUT	SURFACE SOIL SAMPLE	M	Silver	0.87	U	mg/kg	1
SU-31	C-1	0-2	OUT	SURFACE SOIL SAMPLE	M	Thallium	0.58	UNJW	mg/kg	1
SU-31	C-1	0-2	OUT	SURFACE SOIL SAMPLE	M	Zinc	59	NJ	mg/kg	2

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – SOIL

SAMPLE #	GRID #	DEPTH	IN/OUT	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUALIFIER	UNITS	DETECTION LIMIT
SU-32	C-2	0-2	IN	SURFACE SOIL SAMPLE	SV	ALL SEMI-VOLATILES	ND	NA	ug/kg	NA
SU-32	C-2	0-2	IN	SURFACE SOIL SAMPLE	M	Antimony	4.9	UNJ	mg/kg	6
SU-32	C-2	0-2	IN	SURFACE SOIL SAMPLE	M	Arsenic	10.1	NJ	mg/kg	0.5
SU-32	C-2	0-2	IN	SURFACE SOIL SAMPLE	M	Beryllium	0.73		mg/kg	0.5
SU-32	C-2	0-2	IN	SURFACE SOIL SAMPLE	M	Cadmium	0.49	B	mg/kg	1
SU-32	C-2	0-2	IN	SURFACE SOIL SAMPLE	M	Chromium	16.2	NJ	mg/kg	1
SU-32	C-2	0-2	IN	SURFACE SOIL SAMPLE	M	Copper	22.6	*	mg/kg	2.5
SU-32	C-2	0-2	IN	SURFACE SOIL SAMPLE	M	Lead	41.6		mg/kg	0.3
SU-32	C-2	0-2	IN	SURFACE SOIL SAMPLE	M	Mercury	0.061	U	mg/kg	0.1
SU-32	C-2	0-2	IN	SURFACE SOIL SAMPLE	M	Nickel	27.3		mg/kg	4
SU-32	C-2	0-2	IN	SURFACE SOIL SAMPLE	M	Selenium	0.10	UW	mg/kg	0.5
SU-32	C-2	0-2	IN	SURFACE SOIL SAMPLE	M	Silver	0.81	U	mg/kg	1
SU-32	C-2	0-2	IN	SURFACE SOIL SAMPLE	M	Thallium	0.40	UNJW	mg/kg	1
SU-32	C-2	0-2	IN	SURFACE SOIL SAMPLE	M	Zinc	113	NJ	mg/kg	2

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – SOIL

SAMPLE #	GRID #	DEPTH	IN/OUT	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUALIFIER	UNITS	DETECTION LIMIT
SU-33	C-4	0-2	IN	SURFACE SOIL SAMPLE	SV	Phenanthrene	920		ug/kg	330
SU-33	C-4	0-2	IN	SURFACE SOIL SAMPLE	SV	Anthracene	180	J	ug/kg	330
SU-33	C-4	0-2	IN	SURFACE SOIL SAMPLE	SV	Fluoranthene	1900		ug/kg	330
SU-33	C-4	0-2	IN	SURFACE SOIL SAMPLE	SV	Pyrene	2300		ug/kg	330
SU-33	C-4	0-2	IN	SURFACE SOIL SAMPLE	SV	Benzo(a)Anthracene	1400		ug/kg	330
SU-33	C-4	0-2	IN	SURFACE SOIL SAMPLE	SV	Chrysene	1400		ug/kg	330
SU-33	C-4	0-2	IN	SURFACE SOIL SAMPLE	SV	Benzo(b)Fluoranthene	1400		ug/kg	330
SU-33	C-4	0-2	IN	SURFACE SOIL SAMPLE	SV	Benzo(k)Fluoranthene	1200		ug/kg	330
SU-33	C-4	0-2	IN	SURFACE SOIL SAMPLE	SV	Benzo(a)Pyrene	1300		ug/kg	330
SU-33	C-4	0-2	IN	SURFACE SOIL SAMPLE	SV	Indeno(1,2,3-cd)Pyrene	600		ug/kg	330
SU-33	C-4	0-2	IN	SURFACE SOIL SAMPLE	SV	Dibenz(a,h)Anthracene	240	J	ug/kg	330
SU-33	C-4	0-2	IN	SURFACE SOIL SAMPLE	SV	Benzo(g,h,i)Perylene	500		ug/kg	330
SU-33	C-4	0-2	IN	SURFACE SOIL SAMPLE	M	Antimony	5	UNJ	mg/kg	6
SU-33	C-4	0-2	IN	SURFACE SOIL SAMPLE	M	Arsenic	20		mg/kg	0.5
SU-33	C-4	0-2	IN	SURFACE SOIL SAMPLE	M	Beryllium	0.75		mg/kg	0.5
SU-33	C-4	0-2	IN	SURFACE SOIL SAMPLE	M	Cadmium	0.63		mg/kg	1
SU-33	C-4	0-2	IN	SURFACE SOIL SAMPLE	M	Chromium	13.2		mg/kg	1
SU-33	C-4	0-2	IN	SURFACE SOIL SAMPLE	M	Copper	25.5	NJ	mg/kg	2.5
SU-33	C-4	0-2	IN	SURFACE SOIL SAMPLE	M	Lead	112	N*J	mg/kg	0.3
SU-33	C-4	0-2	IN	SURFACE SOIL SAMPLE	M	Mercury	0.064	U	mg/kg	0.1
SU-33	C-4	0-2	IN	SURFACE SOIL SAMPLE	M	Nickel	24.5		mg/kg	4
SU-33	C-4	0-2	IN	SURFACE SOIL SAMPLE	M	Selenium	0.49	BW	mg/kg	0.5
SU-33	C-4	0-2	IN	SURFACE SOIL SAMPLE	M	Silver	0.83	U	mg/kg	1
SU-33	C-4	0-2	IN	SURFACE SOIL SAMPLE	M	Thallium	0.19	BNWJ	mg/kg	1
SU-33	C-4	0-2	IN	SURFACE SOIL SAMPLE	M	Zinc	124	NJ	mg/kg	2

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – SOIL

SAMPLE #	GRID #	DEPTH	IN/OUT	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUALIFIER	UNITS	DETECTION LIMIT
SU-34	C-5	0-2	IN	SURFACE SOIL SAMPLE	SV	ALL SEMI-VOLATILES	ND	NA	ug/kg	NA
SU-34	C-5	0-2	IN	SURFACE SOIL SAMPLE	M	Antimony	4.3	UNJ	mg/kg	6
SU-34	C-5	0-2	IN	SURFACE SOIL SAMPLE	M	Arsenic	15.8	NJ	mg/kg	0.5
SU-34	C-5	0-2	IN	SURFACE SOIL SAMPLE	M	Beryllium	0.53		mg/kg	0.5
SU-34	C-5	0-2	IN	SURFACE SOIL SAMPLE	M	Cadmium	0.2	U	mg/kg	1
SU-34	C-5	0-2	IN	SURFACE SOIL SAMPLE	M	Chromium	11.5	NJ	mg/kg	1
SU-34	C-5	0-2	IN	SURFACE SOIL SAMPLE	M	Copper	20.6	*	mg/kg	2.5
SU-34	C-5	0-2	IN	SURFACE SOIL SAMPLE	M	Lead	19.5		mg/kg	0.3
SU-34	C-5	0-2	IN	SURFACE SOIL SAMPLE	M	Mercury	0.057	U	mg/kg	0.1
SU-34	C-5	0-2	IN	SURFACE SOIL SAMPLE	M	Nickel	24.0		mg/kg	4
SU-34	C-5	0-2	IN	SURFACE SOIL SAMPLE	M	Selenium	0.39	BW	mg/kg	0.5
SU-34	C-5	0-2	IN	SURFACE SOIL SAMPLE	M	Silver	0.7	U	mg/kg	1
SU-34	C-5	0-2	IN	SURFACE SOIL SAMPLE	M	Thallium	0.52	UNWJ	mg/kg	1
SU-34	C-5	0-2	IN	SURFACE SOIL SAMPLE	M	Zinc	75.5	NJ	mg/kg	2
SU-35	C-6	0-2	IN	SURFACE SOIL SAMPLE	SV	Phenanthrene	230	J	ug/kg	330
SU-35	C-6	0-2	IN	SURFACE SOIL SAMPLE	SV	Fluoranthene	420		ug/kg	330
SU-35	C-6	0-2	IN	SURFACE SOIL SAMPLE	SV	Pyrene	340	J	ug/kg	330
SU-35	C-6	0-2	IN	SURFACE SOIL SAMPLE	SV	Benzo(a)Anthracene	180	J	ug/kg	330
SU-35	C-6	0-2	IN	SURFACE SOIL SAMPLE	SV	Chrysene	210	J	ug/kg	330
SU-35	C-6	0-2	IN	SURFACE SOIL SAMPLE	SV	Benzo(b)Fluoranthene	250	J	ug/kg	330
SU-35	C-6	0-2	IN	SURFACE SOIL SAMPLE	SV	Benzo(a)Pyrene	200	J	ug/kg	330
SU-35	C-6	0-2	IN	SURFACE SOIL SAMPLE	M	Antimony	4.5	UNJ	mg/kg	6
SU-35	C-6	0-2	IN	SURFACE SOIL SAMPLE	M	Arsenic	7.9	BNWJ	mg/kg	0.5
SU-35	C-6	0-2	IN	SURFACE SOIL SAMPLE	M	Beryllium	0.79		mg/kg	0.5
SU-35	C-6	0-2	IN	SURFACE SOIL SAMPLE	M	Cadmium	0.23	B	mg/kg	1
SU-35	C-6	0-2	IN	SURFACE SOIL SAMPLE	M	Chromium	14.3	NJ	mg/kg	1
SU-35	C-6	0-2	IN	SURFACE SOIL SAMPLE	M	Copper	17	*	mg/kg	2.5
SU-35	C-6	0-2	IN	SURFACE SOIL SAMPLE	M	Lead	27.1		mg/kg	0.3
SU-35	C-6	0-2	IN	SURFACE SOIL SAMPLE	M	Mercury	0.062	U	mg/kg	0.1
SU-35	C-6	0-2	IN	SURFACE SOIL SAMPLE	M	Nickel	19.7		mg/kg	4
SU-35	C-6	0-2	IN	SURFACE SOIL SAMPLE	M	Selenium	0.2	U	mg/kg	0.5
SU-35	C-6	0-2	IN	SURFACE SOIL SAMPLE	M	Silver	0.74	U	mg/kg	1
SU-35	C-6	0-2	IN	SURFACE SOIL SAMPLE	M	Thallium	0.54	UNWJ	mg/kg	1
SU-35	C-6	0-2	IN	SURFACE SOIL SAMPLE	M	Zinc	93.9	NJ	mg/kg	2

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – SOIL

SAMPLE #	GRID #	DEPTH	IN/OUT	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUALIFIER	UNITS	DETECTION LIMIT
SU-36	C-7	0-2	OUT	SURFACE SOIL SAMPLE	SV	ALL SEMI-VOLATILES	ND	NA	ug/kg	NA
SU-36	C-7	0-2	OUT	SURFACE SOIL SAMPLE	M	Antimony	4.1	UNJ	mg/kg	6
SU-36	C-7	0-2	OUT	SURFACE SOIL SAMPLE	M	Arsenic	9.9	B	mg/kg	0.5
SU-36	C-7	0-2	OUT	SURFACE SOIL SAMPLE	M	Beryllium	0.41	B	mg/kg	0.5
SU-36	C-7	0-2	OUT	SURFACE SOIL SAMPLE	M	Cadmium	0.31	B*	mg/kg	1
SU-36	C-7	0-2	OUT	SURFACE SOIL SAMPLE	M	Chromium	8.7		mg/kg	1
SU-36	C-7	0-2	OUT	SURFACE SOIL SAMPLE	M	Copper	15	*	mg/kg	2.5
SU-36	C-7	0-2	OUT	SURFACE SOIL SAMPLE	M	Lead	24.8	*	mg/kg	0.3
SU-36	C-7	0-2	OUT	SURFACE SOIL SAMPLE	M	Mercury	0.042	U	mg/kg	0.1
SU-36	C-7	0-2	OUT	SURFACE SOIL SAMPLE	M	Nickel	17.9	*	mg/kg	4
SU-36	C-7	0-2	OUT	SURFACE SOIL SAMPLE	M	Selenium	0.25	BW	mg/kg	0.5
SU-36	C-7	0-2	OUT	SURFACE SOIL SAMPLE	M	Silver	0.60	U	mg/kg	1
SU-36	C-7	0-2	OUT	SURFACE SOIL SAMPLE	M	Thallium	0.47	UNWJ	mg/kg	1
SU-36	C-7	0-2	OUT	SURFACE SOIL SAMPLE	M	Zinc	60.2	N*J	mg/kg	2
SU-37	C-8	0-2	OUT	SURFACE SOIL SAMPLE	SV	ALL SEMI-VOLATILES	ND	NA	ug/kg	NA
SU-37	C-8	0-2	OUT	SURFACE SOIL SAMPLE	M	Antimony	4.2	UNJ	mg/kg	6
SU-37	C-8	0-2	OUT	SURFACE SOIL SAMPLE	M	Arsenic	17.6		mg/kg	0.5
SU-37	C-8	0-2	OUT	SURFACE SOIL SAMPLE	M	Beryllium	0.74		mg/kg	0.5
SU-37	C-8	0-2	OUT	SURFACE SOIL SAMPLE	M	Cadmium	0.2	U*	mg/kg	1
SU-37	C-8	0-2	OUT	SURFACE SOIL SAMPLE	M	Chromium	15.7		mg/kg	1
SU-37	C-8	0-2	OUT	SURFACE SOIL SAMPLE	M	Copper	21.9	*	mg/kg	2.5
SU-37	C-8	0-2	OUT	SURFACE SOIL SAMPLE	M	Lead	28.7	*	mg/kg	0.3
SU-37	C-8	0-2	OUT	SURFACE SOIL SAMPLE	M	Mercury	0.066	U	mg/kg	0.1
SU-37	C-8	0-2	OUT	SURFACE SOIL SAMPLE	M	Nickel	20.6	*	mg/kg	4
SU-37	C-8	0-2	OUT	SURFACE SOIL SAMPLE	M	Selenium	0.25	BW	mg/kg	0.5
SU-37	C-8	0-2	OUT	SURFACE SOIL SAMPLE	M	Silver	0.7	U	mg/kg	1
SU-37	C-8	0-2	OUT	SURFACE SOIL SAMPLE	M	Thallium	0.54	UNWJ	mg/kg	1
SU-37	C-8	0-2	OUT	SURFACE SOIL SAMPLE	M	Zinc	95.1	N*J	mg/kg	2

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – SOIL

SAMPLE #	GRID #	DEPTH	IN/OUT	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUALIFIER	UNITS	DETECTION LIMIT
SU-30	D-1	0-2	OUT	SURFACE SOIL SAMPLE	SV	Acenaphthene	170	J	ug/kg	330
SU-30	D-1	0-2	OUT	SURFACE SOIL SAMPLE	SV	Fluorene	150	J	ug/kg	330
SU-30	D-1	0-2	OUT	SURFACE SOIL SAMPLE	SV	Phenanthrene	2000		ug/kg	330
SU-30	D-1	0-2	OUT	SURFACE SOIL SAMPLE	SV	Anthracene	300	J	ug/kg	330
SU-30	D-1	0-2	OUT	SURFACE SOIL SAMPLE	SV	Fluoranthene	2300		ug/kg	330
SU-30	D-1	0-2	OUT	SURFACE SOIL SAMPLE	SV	Pyrene	2100		ug/kg	330
SU-30	D-1	0-2	OUT	SURFACE SOIL SAMPLE	SV	Benzo(a)Anthracene	810		ug/kg	330
SU-30	D-1	0-2	OUT	SURFACE SOIL SAMPLE	SV	Chrysene	860		ug/kg	330
SU-30	D-1	0-2	OUT	SURFACE SOIL SAMPLE	SV	Benzo(b)Fluoranthene	790		ug/kg	330
SU-30	D-1	0-2	OUT	SURFACE SOIL SAMPLE	SV	Benzo(k)Fluoranthene	590		ug/kg	330
SU-30	D-1	0-2	OUT	SURFACE SOIL SAMPLE	SV	Benzo(a)Pyrene	840		ug/kg	330
SU-30	D-1	0-2	OUT	SURFACE SOIL SAMPLE	SV	Indeno(1,2,3-cd)Pyrene	560		ug/kg	330
SU-30	D-1	0-2	OUT	SURFACE SOIL SAMPLE	SV	Benzo(g,h,i)Perylene	490		ug/kg	330
SU-30	D-1	0-2	OUT	SURFACE SOIL SAMPLE	M	Antimony	4.9	UNJ	mg/kg	6
SU-30	D-1	0-2	OUT	SURFACE SOIL SAMPLE	M	Arsenic	13.8		mg/kg	0.5
SU-30	D-1	0-2	OUT	SURFACE SOIL SAMPLE	M	Beryllium	0.62		mg/kg	0.5
SU-30	D-1	0-2	OUT	SURFACE SOIL SAMPLE	M	Cadmium	0.37	B*	mg/kg	1
SU-30	D-1	0-2	OUT	SURFACE SOIL SAMPLE	M	Chromium	13.7		mg/kg	1
SU-30	D-1	0-2	OUT	SURFACE SOIL SAMPLE	M	Copper	22.9	*	mg/kg	2.5
SU-30	D-1	0-2	OUT	SURFACE SOIL SAMPLE	M	Lead	37.4	*	mg/kg	0.3
SU-30	D-1	0-2	OUT	SURFACE SOIL SAMPLE	M	Mercury	0.062	U	mg/kg	0.1
SU-30	D-1	0-2	OUT	SURFACE SOIL SAMPLE	M	Nickel	23.3	*	mg/kg	4
SU-30	D-1	0-2	OUT	SURFACE SOIL SAMPLE	M	Selenium	0.32	BW	mg/kg	0.5
SU-30	D-1	0-2	OUT	SURFACE SOIL SAMPLE	M	Silver	0.81	U	mg/kg	1
SU-30	D-1	0-2	OUT	SURFACE SOIL SAMPLE	M	Thallium	0.55	UNWJ	mg/kg	1
SU-30	D-1	0-2	OUT	SURFACE SOIL SAMPLE	M	Zinc	91.9	N*J	mg/kg	2

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – SOIL

SAMPLE #	GRID #	DEPTH	IN/OUT	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUALIFIER	UNITS	DETECTION LIMIT
SU-39	D-2	0-2	IN	SURFACE SOIL SAMPLE	SV	Pyrene	150	J	ug/kg	330
SU-39	D-2	0-2	IN	SURFACE SOIL SAMPLE	M	Antimony	5.1	UNJ	mg/kg	6
SU-39	D-2	0-2	IN	SURFACE SOIL SAMPLE	M	Arsenic	12.1	B	mg/kg	0.5
SU-39	D-2	0-2	IN	SURFACE SOIL SAMPLE	M	Beryllium	0.63		mg/kg	0.5
SU-39	D-2	0-2	IN	SURFACE SOIL SAMPLE	M	Cadmium	0.38	B*	mg/kg	1
SU-39	D-2	0-2	IN	SURFACE SOIL SAMPLE	M	Chromium	22.8		mg/kg	1
SU-39	D-2	0-2	IN	SURFACE SOIL SAMPLE	M	Copper	30.6	*	mg/kg	2.5
SU-39	D-2	0-2	IN	SURFACE SOIL SAMPLE	M	Lead	73.4	*	mg/kg	0.3
SU-39	D-2	0-2	IN	SURFACE SOIL SAMPLE	M	Mercury	0.050	U	mg/kg	0.1
SU-39	D-2	0-2	IN	SURFACE SOIL SAMPLE	M	Nickel	26.4	*	mg/kg	4
SU-39	D-2	0-2	IN	SURFACE SOIL SAMPLE	M	Selenium	0.29	BW	mg/kg	0.5
SU-39	D-2	0-2	IN	SURFACE SOIL SAMPLE	M	Silver	0.83	U	mg/kg	1
SU-39	D-2	0-2	IN	SURFACE SOIL SAMPLE	M	Thallium	0.66	BNWJ	mg/kg	1
SU-39	D-2	0-2	IN	SURFACE SOIL SAMPLE	M	Zinc	196	N*J	mg/kg	2
SU-40	D-3	0-2	IN	SURFACE SOIL SAMPLE	SV	Phenanthrene	130	J	ug/kg	330
SU-40	D-3	0-2	IN	SURFACE SOIL SAMPLE	SV	Fluoranthene	300	J	ug/kg	330
SU-40	D-3	0-2	IN	SURFACE SOIL SAMPLE	SV	Pyrene	340	J	ug/kg	330
SU-40	D-3	0-2	IN	SURFACE SOIL SAMPLE	SV	Chrysene	310	J	ug/kg	330
SU-40	D-3	0-2	IN	SURFACE SOIL SAMPLE	SV	Benzo(b)Fluoranthene	300	J	ug/kg	330
SU-40	D-3	0-2	IN	SURFACE SOIL SAMPLE	SV	Benzo(k)Fluoranthene	170	J	ug/kg	330
SU-40	D-3	0-2	IN	SURFACE SOIL SAMPLE	SV	Benzo(a)Pyrene	150	J	ug/kg	330
SU-40	D-3	0-2	IN	SURFACE SOIL SAMPLE	M	Antimony	5.2	UNJ	mg/kg	6
SU-40	D-3	0-2	IN	SURFACE SOIL SAMPLE	M	Arsenic	19.6		mg/kg	0.5
SU-40	D-3	0-2	IN	SURFACE SOIL SAMPLE	M	Beryllium	0.78		mg/kg	0.5
SU-40	D-3	0-2	IN	SURFACE SOIL SAMPLE	M	Cadmium	0.39	B*	mg/kg	1
SU-40	D-3	0-2	IN	SURFACE SOIL SAMPLE	M	Chromium	22.7		mg/kg	1
SU-40	D-3	0-2	IN	SURFACE SOIL SAMPLE	M	Copper	36.1	*	mg/kg	2.5
SU-40	D-3	0-2	IN	SURFACE SOIL SAMPLE	M	Lead	44.3	*	mg/kg	0.3
SU-40	D-3	0-2	IN	SURFACE SOIL SAMPLE	M	Mercury	0.074	B	mg/kg	0.1
SU-40	D-3	0-2	IN	SURFACE SOIL SAMPLE	M	Nickel	30.5	*	mg/kg	4
SU-40	D-3	0-2	IN	SURFACE SOIL SAMPLE	M	Selenium	0.32	BW	mg/kg	0.5
SU-40	D-3	0-2	IN	SURFACE SOIL SAMPLE	M	Silver	0.88	U	mg/kg	1
SU-40	D-3	0-2	IN	SURFACE SOIL SAMPLE	M	Thallium	0.95	BNWJ	mg/kg	1
SU-40	D-3	0-2	IN	SURFACE SOIL SAMPLE	M	Zinc	139	N*J	mg/kg	2

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – SOIL

SAMPLE #	GRID #	DEPTH	IN/OUT	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUALIFIER	UNITS	DETECTION LIMIT
SU-41	D-4	0-2	IN	SURFACE SOIL SAMPLE	SV	Fluoranthene	330	J	ug/kg	330
SU-41	D-4	0-2	IN	SURFACE SOIL SAMPLE	SV	Pyrene	300	J	ug/kg	330
SU-41	D-4	0-2	IN	SURFACE SOIL SAMPLE	SV	Chrysene	200	J	ug/kg	330
SU-41	D-4	0-2	IN	SURFACE SOIL SAMPLE	SV	Benzo(b)Fluoranthene	240	J	ug/kg	330
SU-41	D-4	0-2	IN	SURFACE SOIL SAMPLE	SV	Benzo(a)Pyrene	170	J	ug/kg	330
SU-41	D-4	0-2	IN	SURFACE SOIL SAMPLE	M	Antimony	5.1	UNJ	mg/kg	6
SU-41	D-4	0-2	IN	SURFACE SOIL SAMPLE	M	Arsenic	17.0		mg/kg	0.5
SU-41	D-4	0-2	IN	SURFACE SOIL SAMPLE	M	Beryllium	0.38	B	mg/kg	0.5
SU-41	D-4	0-2	IN	SURFACE SOIL SAMPLE	M	Cadmium	0.24	U*	mg/kg	1
SU-41	D-4	0-2	IN	SURFACE SOIL SAMPLE	M	Chromium	12.8		mg/kg	1
SU-41	D-4	0-2	IN	SURFACE SOIL SAMPLE	M	Copper	25.0	*	mg/kg	2.5
SU-41	D-4	0-2	IN	SURFACE SOIL SAMPLE	M	Lead	39.2	*	mg/kg	0.3
SU-41	D-4	0-2	IN	SURFACE SOIL SAMPLE	M	Mercury	0.061	U	mg/kg	0.1
SU-41	D-4	0-2	IN	SURFACE SOIL SAMPLE	M	Nickel	21.5	*	mg/kg	4
SU-41	D-4	0-2	IN	SURFACE SOIL SAMPLE	M	Selenium	0.22	U	mg/kg	0.5
SU-41	D-4	0-2	IN	SURFACE SOIL SAMPLE	M	Silver	0.83	U	mg/kg	1
SU-41	D-4	0-2	IN	SURFACE SOIL SAMPLE	M	Thallium	0.6	BNWJ	mg/kg	1
SU-41	D-4	0-2	IN	SURFACE SOIL SAMPLE	M	Zinc	87.9	N*J	mg/kg	2
SU-42	D-5	0-2	IN	SURFACE SOIL SAMPLE	SV	Fluoranthene	160	J	ug/kg	330
SU-42	D-5	0-2	IN	SURFACE SOIL SAMPLE	SV	Pyrene	190	J	ug/kg	330
SU-42	D-5	0-2	IN	SURFACE SOIL SAMPLE	M	Antimony	5.3	UNJ	mg/kg	6
SU-42	D-5	0-2	IN	SURFACE SOIL SAMPLE	M	Arsenic	16.7		mg/kg	0.5
SU-42	D-5	0-2	IN	SURFACE SOIL SAMPLE	M	Beryllium	0.53	B	mg/kg	0.5
SU-42	D-5	0-2	IN	SURFACE SOIL SAMPLE	M	Cadmium	0.26	B*	mg/kg	1
SU-42	D-5	0-2	IN	SURFACE SOIL SAMPLE	M	Chromium	16		mg/kg	1
SU-42	D-5	0-2	IN	SURFACE SOIL SAMPLE	M	Copper	32.6	*	mg/kg	2.5
SU-42	D-5	0-2	IN	SURFACE SOIL SAMPLE	M	Lead	35	*	mg/kg	0.3
SU-42	D-5	0-2	IN	SURFACE SOIL SAMPLE	M	Mercury	0.067	U	mg/kg	0.1
SU-42	D-5	0-2	IN	SURFACE SOIL SAMPLE	M	Nickel	30.9	*	mg/kg	4
SU-42	D-5	0-2	IN	SURFACE SOIL SAMPLE	M	Selenium	0.38	B	mg/kg	0.5
SU-42	D-5	0-2	IN	SURFACE SOIL SAMPLE	M	Silver	0.87	U	mg/kg	1
SU-42	D-5	0-2	IN	SURFACE SOIL SAMPLE	M	Thallium	0.61	UNWJ	mg/kg	1
SU-42	D-5	0-2	IN	SURFACE SOIL SAMPLE	M	Zinc	109	N*J	mg/kg	2

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – SOIL

SAMPLE #	GRID #	DEPTH	IN/OUT	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUAUFIER	UNITS	DETECTION UMIT
SU-43	D-6	0-2	IN	SURFACE SOIL SAMPLE	SV	ALL SEMI-VOLATILES	ND	NA	ug/kg	NA
SU-43	D-6	0-2	IN	SURFACE SOIL SAMPLE	M	Antimony	4.7	UNJ	mg/kg	6
SU-43	D-6	0-2	IN	SURFACE SOIL SAMPLE	M	Arsenic	8.3	B	mg/kg	0.5
SU-43	D-6	0-2	IN	SURFACE SOIL SAMPLE	M	Beryllium	0.50		mg/kg	0.5
SU-43	D-6	0-2	IN	SURFACE SOIL SAMPLE	M	Cadmium	0.22	U*	mg/kg	1
SU-43	D-6	0-2	IN	SURFACE SOIL SAMPLE	M	Chromium	17.5		mg/kg	1
SU-43	D-6	0-2	IN	SURFACE SOIL SAMPLE	M	Copper	29.2	*	mg/kg	2.5
SU-43	D-6	0-2	IN	SURFACE SOIL SAMPLE	M	Lead	26.4	*	mg/kg	0.3
SU-43	D-6	0-2	IN	SURFACE SOIL SAMPLE	M	Mercury	0.06	U	mg/kg	0.1
SU-43	D-6	0-2	IN	SURFACE SOIL SAMPLE	M	Nickel	31.0	*	mg/kg	4
SU-43	D-6	0-2	IN	SURFACE SOIL SAMPLE	M	Selenium	0.25	B	mg/kg	0.5
SU-43	D-6	0-2	IN	SURFACE SOIL SAMPLE	M	Silver	0.76	U	mg/kg	1
SU-43	D-6	0-2	IN	SURFACE SOIL SAMPLE	M	Thallium	0.54	UNWJ	mg/kg	1
SU-43	D-6	0-2	IN	SURFACE SOIL SAMPLE	M	Zinc	110	N*J	mg/kg	2

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – SOIL

SAMPLE #	GRID #	DEPTH	IN/OUT	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUALIFIER	UNITS	DETECTION LIMIT
SU-44	D-7	0-2	OUT	SURFACE SOIL SAMPLE	SV	2-Chlorophenol	0	J	ug/kg	330
SU-44	D-7	0-2	OUT	SURFACE SOIL SAMPLE	SV	3-Nitroaniline	24	J	ug/kg	1600
SU-44	D-7	0-2	OUT	SURFACE SOIL SAMPLE	SV	Acenaphthene	2	J	ug/kg	330
SU-44	D-7	0-2	OUT	SURFACE SOIL SAMPLE	SV	4-Nitroaniline	30	J	ug/kg	1600
SU-44	D-7	0-2	OUT	SURFACE SOIL SAMPLE	SV	Phenanthrene	10	J	ug/kg	330
SU-44	D-7	0-2	OUT	SURFACE SOIL SAMPLE	SV	bis(2-Chloroethyl)ether	8	J	ug/kg	330
SU-44	D-7	0-2	OUT	SURFACE SOIL SAMPLE	SV	Anthracene	17	J	ug/kg	330
SU-44	D-7	0-2	OUT	SURFACE SOIL SAMPLE	SV	Fluoranthene	16	J	ug/kg	330
SU-44	D-7	0-2	OUT	SURFACE SOIL SAMPLE	SV	Pyrene	39	J	ug/kg	330
SU-44	D-7	0-2	OUT	SURFACE SOIL SAMPLE	SV	Benzo(a)Anthracene	35	J	ug/kg	330
SU-44	D-7	0-2	OUT	SURFACE SOIL SAMPLE	SV	Chrysene	36	J	ug/kg	330
SU-44	D-7	0-2	OUT	SURFACE SOIL SAMPLE	SV	Benzo(b)Fluoranthene	40	J	ug/kg	330
SU-44	D-7	0-2	OUT	SURFACE SOIL SAMPLE	SV	Benzo(a)Pyrene	50	J	ug/kg	330
SU-44	D-7	0-2	OUT	SURFACE SOIL SAMPLE	SV	Indeno(1,2,3-cd)Pyrene	20	J	ug/kg	330
SU-44	D-7	0-2	OUT	SURFACE SOIL SAMPLE	SV	Benzo(g,h,i)Perylene	56	J	ug/kg	330
SU-44	D-7	0-2	OUT	SURFACE SOIL SAMPLE	M	Antimony	4.7	UNJ	mg/kg	6
SU-44	D-7	0-2	OUT	SURFACE SOIL SAMPLE	M	Arsenic	7.6	B	mg/kg	0.5
SU-44	D-7	0-2	OUT	SURFACE SOIL SAMPLE	M	Beryllium	0.47	B	mg/kg	0.5
SU-44	D-7	0-2	OUT	SURFACE SOIL SAMPLE	M	Cadmium	1.6	*	mg/kg	1
SU-44	D-7	0-2	OUT	SURFACE SOIL SAMPLE	M	Chromium	14		mg/kg	1
SU-44	D-7	0-2	OUT	SURFACE SOIL SAMPLE	M	Copper	45.3	*	mg/kg	2.5
SU-44	D-7	0-2	OUT	SURFACE SOIL SAMPLE	M	Lead	77	*	mg/kg	0.3
SU-44	D-7	0-2	OUT	SURFACE SOIL SAMPLE	M	Mercury	0.055	U	mg/kg	0.1
SU-44	D-7	0-2	OUT	SURFACE SOIL SAMPLE	M	Nickel	17.9	*	mg/kg	4
SU-44	D-7	0-2	OUT	SURFACE SOIL SAMPLE	M	Selenium	0.17	UW	mg/kg	0.5
SU-44	D-7	0-2	OUT	SURFACE SOIL SAMPLE	M	Silver	0.77	U	mg/kg	1
SU-44	D-7	0-2	OUT	SURFACE SOIL SAMPLE	M	Thallium	0.45	UNWJ	mg/kg	1
SU-44	D-7	0-2	OUT	SURFACE SOIL SAMPLE	M	Zinc	60.3	N*J	mg/kg	2

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – SOIL

SAMPLE #	GRID #	DEPTH	IN/OUT	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUALIFIER	UNITS	DETECTION LIMIT
SU-45	E-2	0-2	OUT	SURFACE SOIL SAMPLE	SV	Phenanthrene	11000		ug/kg	330
SU-45	E-2	0-2	OUT	SURFACE SOIL SAMPLE	SV	Anthracene	2200	J	ug/kg	330
SU-45	E-2	0-2	OUT	SURFACE SOIL SAMPLE	SV	Fluoranthene	23000		ug/kg	330
SU-45	E-2	0-2	OUT	SURFACE SOIL SAMPLE	SV	Pyrene	25000		ug/kg	330
SU-45	E-2	0-2	OUT	SURFACE SOIL SAMPLE	SV	Benzo(a)Anthracene	15000		ug/kg	330
SU-45	E-2	0-2	OUT	SURFACE SOIL SAMPLE	SV	Chrysene	17000		ug/kg	330
SU-45	E-2	0-2	OUT	SURFACE SOIL SAMPLE	SV	Benzo(k)Fluoranthene	20000		ug/kg	330
SU-45	E-2	0-2	OUT	SURFACE SOIL SAMPLE	SV	Benzo(b)Fluoranthene	14000		ug/kg	330
SU-45	E-2	0-2	OUT	SURFACE SOIL SAMPLE	SV	Benzo(a)Pyrene	15000		ug/kg	330
SU-45	E-2	0-2	OUT	SURFACE SOIL SAMPLE	SV	Indeno(1,2,3-cd)Pyrene	10000		ug/kg	330
SU-45	E-2	0-2	OUT	SURFACE SOIL SAMPLE	SV	Dibenz(a,h)Anthracene	3500		ug/kg	330
SU-45	E-2	0-2	OUT	SURFACE SOIL SAMPLE	SV	Benzo(g,h,i)Perylene	8600		ug/kg	330
SU-45	E-2	0-2	OUT	SURFACE SOIL SAMPLE	M	Antimony	4.3	UNJ	mg/kg	6
SU-45	E-2	0-2	OUT	SURFACE SOIL SAMPLE	M	Arsenic	4.0	B	mg/kg	0.5
SU-45	E-2	0-2	OUT	SURFACE SOIL SAMPLE	M	Beryllium	0.25	U	mg/kg	0.5
SU-45	E-2	0-2	OUT	SURFACE SOIL SAMPLE	M	Cadmium	1.9	*	mg/kg	1
SU-45	E-2	0-2	OUT	SURFACE SOIL SAMPLE	M	Chromium	12.5		mg/kg	1
SU-45	E-2	0-2	OUT	SURFACE SOIL SAMPLE	M	Copper	11.9	*	mg/kg	2.5
SU-45	E-2	0-2	OUT	SURFACE SOIL SAMPLE	M	Lead	32.4	*	mg/kg	0.3
SU-45	E-2	0-2	OUT	SURFACE SOIL SAMPLE	M	Mercury	0.053	U	mg/kg	0.1
SU-45	E-2	0-2	OUT	SURFACE SOIL SAMPLE	M	Nickel	13.8	*	mg/kg	4
SU-45	E-2	0-2	OUT	SURFACE SOIL SAMPLE	M	Selenium	0.19	UW	mg/kg	0.5
SU-45	E-2	0-2	OUT	SURFACE SOIL SAMPLE	M	Silver	0.71	U	mg/kg	1
SU-45	E-2	0-2	OUT	SURFACE SOIL SAMPLE	M	Thallium	0.5	UNWJ	mg/kg	1
SU-45	E-2	0-2	OUT	SURFACE SOIL SAMPLE	M	Zinc	43.9	N*J	mg/kg	2

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – SOIL

SAMPLE #	GRID #	DEPTH	IN/OUT	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUALIFIER	UNITS	DETECTION LIMIT
SU-46	E-3	0-2	OUT	SURFACE SOIL SAMPLE	SV	Phenanthrene	5100		ug/kg	330
SU-46	E-3	0-2	OUT	SURFACE SOIL SAMPLE	SV	Anthracene	970	J	ug/kg	330
SU-46	E-3	0-2	OUT	SURFACE SOIL SAMPLE	SV	Fluoranthene	7500		ug/kg	330
SU-46	E-3	0-2	OUT	SURFACE SOIL SAMPLE	SV	Pyrene	11000		ug/kg	330
SU-46	E-3	0-2	OUT	SURFACE SOIL SAMPLE	SV	Benzo(a)Anthracene	5000		ug/kg	330
SU-46	E-3	0-2	OUT	SURFACE SOIL SAMPLE	SV	Chrysene	6700		ug/kg	330
SU-46	E-3	0-2	OUT	SURFACE SOIL SAMPLE	SV	Benzo(b)Fluoranthene	8400		ug/kg	330
SU-46	E-3	0-2	OUT	SURFACE SOIL SAMPLE	SV	Benzo(k)Fluoranthene	6000		ug/kg	330
SU-46	E-3	0-2	OUT	SURFACE SOIL SAMPLE	SV	Benzo(a)Pyrene	6600		ug/kg	330
SU-46	E-3	0-2	OUT	SURFACE SOIL SAMPLE	SV	Indeno(1,2,3-cd)Pyrene	4000		ug/kg	330
SU-46	E-3	0-2	OUT	SURFACE SOIL SAMPLE	SV	Dibenz(a,h)Anthracene	1900	J	ug/kg	330
SU-46	E-3	0-2	OUT	SURFACE SOIL SAMPLE	SV	Benzo(g,h,i)Perylene	4700		ug/kg	330
SU-46	E-3	0-2	OUT	SURFACE SOIL SAMPLE	M	Antimony	4.2	UNJ	mg/kg	6
SU-46	E-3	0-2	OUT	SURFACE SOIL SAMPLE	M	Arsenic	7.2	B	mg/kg	0.5
SU-46	E-3	0-2	OUT	SURFACE SOIL SAMPLE	M	Beryllium	0.40	B	mg/kg	0.5
SU-46	E-3	0-2	OUT	SURFACE SOIL SAMPLE	M	Cadmium	1.0	*	mg/kg	1
SU-46	E-3	0-2	OUT	SURFACE SOIL SAMPLE	M	Chromium	13.0		mg/kg	1
SU-46	E-3	0-2	OUT	SURFACE SOIL SAMPLE	M	Copper	10.4	*	mg/kg	2.5
SU-46	E-3	0-2	OUT	SURFACE SOIL SAMPLE	M	Lead	54.9	*	mg/kg	0.3
SU-46	E-3	0-2	OUT	SURFACE SOIL SAMPLE	M	Mercury	0.056	U	mg/kg	0.1
SU-46	E-3	0-2	OUT	SURFACE SOIL SAMPLE	M	Nickel	19.7	*	mg/kg	4
SU-46	E-3	0-2	OUT	SURFACE SOIL SAMPLE	M	Selenium	0.23	BW	mg/kg	0.5
SU-46	E-3	0-2	OUT	SURFACE SOIL SAMPLE	M	Silver	1.0		mg/kg	1
SU-46	E-3	0-2	OUT	SURFACE SOIL SAMPLE	M	Thallium	0.51	UNWJ	mg/kg	1
SU-46	E-3	0-2	OUT	SURFACE SOIL SAMPLE	M	Zinc	113	N*J	mg/kg	2

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – SOIL

SAMPLE #	GRID #	DEPTH	IN/OUT	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUALIFIER	UNITS	DETECTION LIMIT
SU-47	E-4	0-2	OUT	SURFACE SOIL SAMPLE	SV	Fluoranthene	160	J	ug/kg	330
SU-47	E-4	0-2	OUT	SURFACE SOIL SAMPLE	SV	Benzo(b)Fluoranthene	130	J	ug/kg	330
SU-47	E-4	0-2	OUT	SURFACE SOIL SAMPLE	M	Antimony	4.7	UNJ	mg/kg	6
SU-47	E-4	0-2	OUT	SURFACE SOIL SAMPLE	M	Arsenic	14.4		mg/kg	0.5
SU-47	E-4	0-2	OUT	SURFACE SOIL SAMPLE	M	Beryllium	0.59		mg/kg	0.5
SU-47	E-4	0-2	OUT	SURFACE SOIL SAMPLE	M	Cadmium	0.59	*	mg/kg	1
SU-47	E-4	0-2	OUT	SURFACE SOIL SAMPLE	M	Chromium	10		mg/kg	1
SU-47	E-4	0-2	OUT	SURFACE SOIL SAMPLE	M	Copper	29.3	*	mg/kg	2.5
SU-47	E-4	0-2	OUT	SURFACE SOIL SAMPLE	M	Lead	41.2	*	mg/kg	0.3
SU-47	E-4	0-2	OUT	SURFACE SOIL SAMPLE	M	Mercury	0.056	U	mg/kg	0.1
SU-47	E-4	0-2	OUT	SURFACE SOIL SAMPLE	M	Nickel	29.6	*	mg/kg	4
SU-47	E-4	0-2	OUT	SURFACE SOIL SAMPLE	M	Selenium	0.44	BW	mg/kg	0.5
SU-47	E-4	0-2	OUT	SURFACE SOIL SAMPLE	M	Silver	0.77	U	mg/kg	1
SU-47	E-4	0-2	OUT	SURFACE SOIL SAMPLE	M	Thallium	0.49	UNWJ	mg/kg	1
SU-47	E-4	0-2	OUT	SURFACE SOIL SAMPLE	M	Zinc	111	N*J	mg/kg	2
SU-48	E-6	0-2	OUT	SURFACE SOIL SAMPLE	SV	Phenanthrene	170	J	ug/kg	330
SU-48	E-6	0-2	OUT	SURFACE SOIL SAMPLE	SV	Fluoranthene	300	J	ug/kg	330
SU-48	E-6	0-2	OUT	SURFACE SOIL SAMPLE	SV	Pyrene	270	J	ug/kg	330
SU-48	E-6	0-2	OUT	SURFACE SOIL SAMPLE	SV	Chrysene	170	J	ug/kg	330
SU-48	E-6	0-2	OUT	SURFACE SOIL SAMPLE	SV	Benzo(a)Pyrene	130	J	ug/kg	330
SU-48	E-6	0-2	OUT	SURFACE SOIL SAMPLE	M	Antimony	4.9	UNJ	mg/kg	6
SU-48	E-6	0-2	OUT	SURFACE SOIL SAMPLE	M	Arsenic	10.8	S	mg/kg	0.5
SU-48	E-6	0-2	OUT	SURFACE SOIL SAMPLE	M	Beryllium	0.49	B	mg/kg	0.5
SU-48	E-6	0-2	OUT	SURFACE SOIL SAMPLE	M	Cadmium	0.05	*	mg/kg	1
SU-48	E-6	0-2	OUT	SURFACE SOIL SAMPLE	M	Chromium	15.4		mg/kg	1
SU-48	E-6	0-2	OUT	SURFACE SOIL SAMPLE	M	Copper	32.7	*	mg/kg	2.5
SU-48	E-6	0-2	OUT	SURFACE SOIL SAMPLE	M	Lead	43.7	*	mg/kg	0.3
SU-48	E-6	0-2	OUT	SURFACE SOIL SAMPLE	M	Mercury	0.06	U	mg/kg	0.1
SU-48	E-6	0-2	OUT	SURFACE SOIL SAMPLE	M	Nickel	31.8	*	mg/kg	4
SU-48	E-6	0-2	OUT	SURFACE SOIL SAMPLE	M	Selenium	0.59	BW	mg/kg	0.5
SU-48	E-6	0-2	OUT	SURFACE SOIL SAMPLE	M	Silver	0.8	U	mg/kg	1
SU-48	E-6	0-2	OUT	SURFACE SOIL SAMPLE	M	Thallium	0.56	UNWJ	mg/kg	1
SU-48	E-6	0-2	OUT	SURFACE SOIL SAMPLE	M	Zinc	198	N*J	mg/kg	2

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – SOIL

SAMPLE #	GRID #	DEPTH	IN/OUT	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUALIFIER	UNITS	DETECTION LIMIT
SU-49	B-4	0-2	IN	SURFACE SOIL SAMPLE	SV	Phenanthrene	240	J	ug/kg	330
SU-49	B-4	0-2	IN	SURFACE SOIL SAMPLE	SV	Fluoranthene	450		ug/kg	330
SU-49	B-4	0-2	IN	SURFACE SOIL SAMPLE	SV	Pyrene	460		ug/kg	330
SU-49	B-4	0-2	IN	SURFACE SOIL SAMPLE	SV	Benzo(a)Anthracene	220	J	ug/kg	330
SU-49	B-4	0-2	IN	SURFACE SOIL SAMPLE	SV	Chrysene	250	J	ug/kg	330
SU-49	B-4	0-2	IN	SURFACE SOIL SAMPLE	SV	Benzo(k)Fluoranthene	130	J	ug/kg	330
SU-49	B-4	0-2	IN	SURFACE SOIL SAMPLE	SV	Benzo(b)Fluoranthene	320	J	ug/kg	330
SU-49	B-4	0-2	IN	SURFACE SOIL SAMPLE	SV	Benzo(a)Pyrene	220	J	ug/kg	330
SU-49	B-4	0-2	IN	SURFACE SOIL SAMPLE	SV	Indeno(1,2,3-cd)Pyrene	140	J	ug/kg	330
SU-49	B-4	0-2	IN	SURFACE SOIL SAMPLE	M	Antimony	4.9	UNJ	mg/kg	6
SU-49	B-4	0-2	IN	SURFACE SOIL SAMPLE	M	Arsenic	16.0	S	mg/kg	0.5
SU-49	B-4	0-2	IN	SURFACE SOIL SAMPLE	M	Beryllium	0.49	B	mg/kg	0.5
SU-49	B-4	0-2	IN	SURFACE SOIL SAMPLE	M	Cadmium	0.05	*	mg/kg	1
SU-49	B-4	0-2	IN	SURFACE SOIL SAMPLE	M	Chromium	15.4		mg/kg	1
SU-49	B-4	0-2	IN	SURFACE SOIL SAMPLE	M	Copper	32.7	*	mg/kg	2.5
SU-49	B-4	0-2	IN	SURFACE SOIL SAMPLE	M	Lead	43.7	*	mg/kg	0.3
SU-49	B-4	0-2	IN	SURFACE SOIL SAMPLE	M	Mercury	0.06	U	mg/kg	0.1
SU-49	B-4	0-2	IN	SURFACE SOIL SAMPLE	M	Nickel	31.0	*	mg/kg	4
SU-49	B-4	0-2	IN	SURFACE SOIL SAMPLE	M	Selenium	0.59	BW	mg/kg	0.5
SU-49	B-4	0-2	IN	SURFACE SOIL SAMPLE	M	Silver	0.0	U	mg/kg	1
SU-49	B-4	0-2	IN	SURFACE SOIL SAMPLE	M	Thallium	0.56	UNWJ	mg/kg	1
SU-49	B-4	0-2	IN	SURFACE SOIL SAMPLE	M	Zinc	190	N*J	mg/kg	2
AB1-SS1	B-2	3-5	IN	AUGER BORING	V	ALL VOLATILES	ND	NA	ug/kg	NA
AB1-SS1	B-2	3-5	IN	AUGER BORING	SV	ALL SEMI-VOLATILES	ND	NA	ug/kg	NA
AB1-SS1	B-2	3-5	IN	AUGER BORING	M	Antimony	4.0	UNR	mg/kg	6
AB1-SS1	B-2	3-5	IN	AUGER BORING	M	Arsenic	22.9	NJ	mg/kg	1
AB1-SS1	B-2	3-5	IN	AUGER BORING	M	Beryllium	0.59		mg/kg	0.5
AB1-SS1	B-2	3-5	IN	AUGER BORING	M	Cadmium	0.47	B	mg/kg	0.5
AB1-SS1	B-2	3-5	IN	AUGER BORING	M	Chromium	17.3		mg/kg	1
AB1-SS1	B-2	3-5	IN	AUGER BORING	M	Copper	34.7		mg/kg	2.5
AB1-SS1	B-2	3-5	IN	AUGER BORING	M	Lead	22		mg/kg	0.3
AB1-SS1	B-2	3-5	IN	AUGER BORING	M	Mercury	0.059	U	mg/kg	0.1
AB1-SS1	B-2	3-5	IN	AUGER BORING	M	Nickel	35.3		mg/kg	4
AB1-SS1	B-2	3-5	IN	AUGER BORING	M	Selenium	0.2	UNWJ	mg/kg	0.5
AB1-SS1	B-2	3-5	IN	AUGER BORING	M	Silver	0.70	U	mg/kg	1
AB1-SS1	B-2	3-5	IN	AUGER BORING	M	Thallium	1.2	BNJ	mg/kg	1
AB1-SS1	B-2	3-5	IN	AUGER BORING	M	Zinc	101		mg/kg	2

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – SOIL

SAMPLE #	GRID #	DEPTH	IN/OUT	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUALIFIER	UNITS	DETECTION LIMIT
AB1-SS2	B-2	0-10	IN	AUGER BORING	V	Ethylbenzene	6700		ug/kg	5
AB1-SS2	B-2	0-10	IN	AUGER BORING	V	m/p-Xylene	6000		ug/kg	5
AB1-SS2	B-2	0-10	IN	AUGER BORING	V	o-Xylene	12000		ug/kg	5
AB1-SS2	B-2	0-10	IN	AUGER BORING	SV	Naphthalene	130	J	ug/kg	330
AB1-SS2	B-2	0-10	IN	AUGER BORING	M	Antimony	4.7	UNR	mg/kg	6
AB1-SS2	B-2	0-10	IN	AUGER BORING	M	Arsenic	16.1	NJ	mg/kg	1
AB1-SS2	B-2	0-10	IN	AUGER BORING	M	Beryllium	0.35	B	mg/kg	0.5
AB1-SS2	B-2	0-10	IN	AUGER BORING	M	Cadmium	0.35	B	mg/kg	0.5
AB1-SS2	B-2	0-10	IN	AUGER BORING	M	Chromium	10.0		mg/kg	1
AB1-SS2	B-2	0-10	IN	AUGER BORING	M	Copper	25.6		mg/kg	2.5
AB1-SS2	B-2	0-10	IN	AUGER BORING	M	Lead	22.0	*	mg/kg	0.3
AB1-SS2	B-2	0-10	IN	AUGER BORING	M	Mercury	0.050	U	mg/kg	0.1
AB1-SS2	B-2	0-10	IN	AUGER BORING	M	Nickel	29		mg/kg	4
AB1-SS2	B-2	0-10	IN	AUGER BORING	M	Selenium	0.52	BNWJ	mg/kg	0.5
AB1-SS2	B-2	0-10	IN	AUGER BORING	M	Silver	0.77	U	mg/kg	1
AB1-SS2	B-2	0-10	IN	AUGER BORING	M	Thallium	0.47	BNJ	mg/kg	1
AB1-SS2	B-2	0-10	IN	AUGER BORING	M	Zinc	92.1		mg/kg	2
AB2-SS1	B-4	3-5	IN	AUGER BORING	V	Benzene	1	J	ug/kg	5
AB2-SS1	B-4	3-5	IN	AUGER BORING	SV	Naphthalene	1200		ug/kg	330
AB2-SS1	B-4	3-5	IN	AUGER BORING	M	Antimony	4.6	UNR	mg/kg	6
AB2-SS1	B-4	3-5	IN	AUGER BORING	M	Arsenic	10.0	NJ	mg/kg	1
AB2-SS1	B-4	3-5	IN	AUGER BORING	M	Beryllium	0.57	B	mg/kg	0.5
AB2-SS1	B-4	3-5	IN	AUGER BORING	M	Cadmium	0.34	B	mg/kg	0.5
AB2-SS1	B-4	3-5	IN	AUGER BORING	M	Chromium	14.9		mg/kg	1
AB2-SS1	B-4	3-5	IN	AUGER BORING	M	Copper	30.3		mg/kg	2.5
AB2-SS1	B-4	3-5	IN	AUGER BORING	M	Lead	17.9		mg/kg	0.3
AB2-SS1	B-4	3-5	IN	AUGER BORING	M	Mercury	0.057	U	mg/kg	0.1
AB2-SS1	B-4	3-5	IN	AUGER BORING	M	Nickel	37.6		mg/kg	4
AB2-SS1	B-4	3-5	IN	AUGER BORING	M	Selenium	0.19	UNWJ	mg/kg	0.5
AB2-SS1	B-4	3-5	IN	AUGER BORING	M	Silver	0.75	U	mg/kg	1
AB2-SS1	B-4	3-5	IN	AUGER BORING	M	Thallium	1.1	BNJ	mg/kg	1
AB2-SS1	B-4	3-5	IN	AUGER BORING	M	Zinc	91.1		mg/kg	2

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – SOIL

SAMPLE #	GRID #	DEPTH	IN/OUT	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUALIFIER	UNITS	DETECTION LIMIT
AB2-SS2	B-4	0-10	IN	AUGER BORING	V	ALL VOLATILES	ND	NA	ug/kg	NA
AB2-SS2	B-4	0-10	IN	AUGER BORING	SV	Naphthalene	1000		ug/kg	330
AB2-SS2	B-4	0-10	IN	AUGER BORING	M	Antimony	4.7	UNR	mg/kg	6
AB2-SS2	B-4	0-10	IN	AUGER BORING	M	Arsenic	13.7	NJ	mg/kg	1
AB2-SS2	B-4	0-10	IN	AUGER BORING	M	Beryllium	0.35	B	mg/kg	0.5
AB2-SS2	B-4	0-10	IN	AUGER BORING	M	Cadmium	0.35	B	mg/kg	0.5
AB2-SS2	B-4	0-10	IN	AUGER BORING	M	Chromium	13.4		mg/kg	1
AB2-SS2	B-4	0-10	IN	AUGER BORING	M	Copper	25.9		mg/kg	2.5
AB2-SS2	B-4	0-10	IN	AUGER BORING	M	Lead	15.3		mg/kg	0.3
AB2-SS2	B-4	0-10	IN	AUGER BORING	M	Mercury	0.085	U	mg/kg	0.1
AB2-SS2	B-4	0-10	IN	AUGER BORING	M	Nickel	25.9		mg/kg	4
AB2-SS2	B-4	0-10	IN	AUGER BORING	M	Selenium	0.59	NJ	mg/kg	0.5
AB2-SS2	B-4	0-10	IN	AUGER BORING	M	Silver	0.77	U	mg/kg	1
AB2-SS2	B-4	0-10	IN	AUGER BORING	M	Thallium	0.72	BNJ	mg/kg	1
AB2-SS2	B-4	0-10	IN	AUGER BORING	M	Zinc	84		mg/kg	2
AB3-SS1	B-5	3-5	IN	AUGER BORING	V	ALL VOLATILES	ND	NA	ug/kg	NA
AB3-SS1	B-5	3-5	IN	AUGER BORING	SV	ALL SEMI-VOLATILES	ND	NA	ug/kg	NA
AB3-SS1	B-5	3-5	IN	AUGER BORING	M	Antimony	4.7	UNR	mg/kg	6
AB3-SS1	B-5	3-5	IN	AUGER BORING	M	Arsenic	20.4	NJ	mg/kg	1
AB3-SS1	B-5	3-5	IN	AUGER BORING	M	Beryllium	0.58		mg/kg	0.5
AB3-SS1	B-5	3-5	IN	AUGER BORING	M	Cadmium	0.50		mg/kg	0.5
AB3-SS1	B-5	3-5	IN	AUGER BORING	M	Chromium	17.4		mg/kg	1
AB3-SS1	B-5	3-5	IN	AUGER BORING	M	Copper	24.9		mg/kg	2.5
AB3-SS1	B-5	3-5	IN	AUGER BORING	M	Lead	20.1		mg/kg	0.3
AB3-SS1	B-5	3-5	IN	AUGER BORING	M	Mercury	0.06	U	mg/kg	0.1
AB3-SS1	B-5	3-5	IN	AUGER BORING	M	Nickel	25.2		mg/kg	4
AB3-SS1	B-5	3-5	IN	AUGER BORING	M	Selenium	0.32	BNJ	mg/kg	0.5
AB3-SS1	B-5	3-5	IN	AUGER BORING	M	Silver	0.77	U	mg/kg	1
AB3-SS1	B-5	3-5	IN	AUGER BORING	M	Thallium	0.59	BNJ	mg/kg	1
AB3-SS1	B-5	3-5	IN	AUGER BORING	M	Zinc	82.6		mg/kg	2

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – SOIL

SAMPLE #	GRID #	DEPTH	IN/OUT	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUALIFIER	UNITS	DETECTION LIMIT
AB3-SS2	B-5	8-10	IN	AUGER BORING	V	Benzene	39		ug/kg	5
AB3-SS2	B-5	8-10	IN	AUGER BORING	SV	ALL SEMI-VOLATILES	ND	NA	ug/kg	NA
AB3-SS2	B-5	8-10	IN	AUGER BORING	M	Antimony	4.5	UNR	mg/kg	6
AB3-SS2	B-5	8-10	IN	AUGER BORING	M	Arsenic	12.0	NJ	mg/kg	1
AB3-SS2	B-5	8-10	IN	AUGER BORING	M	Beryllium	0.34	B	mg/kg	0.5
AB3-SS2	B-5	8-10	IN	AUGER BORING	M	Cadmium	0.45	B	mg/kg	0.5
AB3-SS2	B-5	8-10	IN	AUGER BORING	M	Chromium	10.0		mg/kg	1
AB3-SS2	B-5	8-10	IN	AUGER BORING	M	Copper	20		mg/kg	2.5
AB3-SS2	B-5	8-10	IN	AUGER BORING	M	Lead	14.0		mg/kg	0.3
AB3-SS2	B-5	8-10	IN	AUGER BORING	M	Mercury	0.057	U	mg/kg	0.1
AB3-SS2	B-5	8-10	IN	AUGER BORING	M	Nickel	21.0		mg/kg	4
AB3-SS2	B-5	8-10	IN	AUGER BORING	M	Selenium	0.55	NWJ	mg/kg	0.5
AB3-SS2	B-5	8-10	IN	AUGER BORING	M	Silver	0.74	U	mg/kg	1
AB3-SS2	B-5	8-10	IN	AUGER BORING	M	Thallium	0.36	BNJ	mg/kg	1
AB3-SS2	B-5	8-10	IN	AUGER BORING	M	Zinc	80.9		mg/kg	2
AB4-SS1	B-6	3-5	IN	AUGER BORING	V	ALL VOLATILES	ND	NA	ug/kg	NA
AB4-SS1	B-6	3-5	IN	AUGER BORING	SV	Fluoranthene	100	J	ug/kg	330
AB4-SS1	B-6	3-5	IN	AUGER BORING	SV	Pyrene	100	J	ug/kg	330
AB4-SS1	B-6	3-5	IN	AUGER BORING	SV	Benzo(b)Fluoranthene	170	J	ug/kg	330
AB4-SS1	B-6	3-5	IN	AUGER BORING	M	Antimony	5	UNR	mg/kg	6
AB4-SS1	B-6	3-5	IN	AUGER BORING	M	Arsenic	15.2	NJ	mg/kg	1
AB4-SS1	B-6	3-5	IN	AUGER BORING	M	Beryllium	1		mg/kg	0.5
AB4-SS1	B-6	3-5	IN	AUGER BORING	M	Cadmium	0.5	B	mg/kg	0.5
AB4-SS1	B-6	3-5	IN	AUGER BORING	M	Chromium	22.3		mg/kg	1
AB4-SS1	B-6	3-5	IN	AUGER BORING	M	Copper	21.2		mg/kg	2.5
AB4-SS1	B-6	3-5	IN	AUGER BORING	M	Lead	302	*	mg/kg	0.3
AB4-SS1	B-6	3-5	IN	AUGER BORING	M	Mercury	0.06	U	mg/kg	0.1
AB4-SS1	B-6	3-5	IN	AUGER BORING	M	Nickel	21.0		mg/kg	4
AB4-SS1	B-6	3-5	IN	AUGER BORING	M	Selenium	0.47	BNJ	mg/kg	0.5
AB4-SS1	B-6	3-5	IN	AUGER BORING	M	Silver	0.83	U	mg/kg	1
AB4-SS1	B-6	3-5	IN	AUGER BORING	M	Thallium	0.61	BNJ	mg/kg	1
AB4-SS1	B-6	3-5	IN	AUGER BORING	M	Zinc	166		mg/kg	2

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – SOIL

SAMPLE #	GRID #	DEPTH	IN/OUT	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUALIFIER	UNITS	DETECTION LIMIT
AB4-SS2	B-6	8-10	IN	AUGER BORING	V	Acetone	250	D	ug/kg	100
AB4-SS2	B-6	8-10	IN	AUGER BORING	V	Ethylbenzene	20		ug/kg	5
AB4-SS2	B-6	8-10	IN	AUGER BORING	V	m/p-Xylene	36		ug/kg	5
AB4-SS2	B-6	8-10	IN	AUGER BORING	V	o-Xylene	51		ug/kg	5
AB4-SS2	B-6	8-10	IN	AUGER BORING	SV	Naphthalene	800		ug/kg	330
AB4-SS2	B-6	8-10	IN	AUGER BORING	SV	Phenanthrene	160	J	ug/kg	330
AB4-SS2	B-6	8-10	IN	AUGER BORING	SV	Fluoranthene	160	J	ug/kg	330
AB4-SS2	B-6	8-10	IN	AUGER BORING	SV	Pyrene	120	J	ug/kg	330
AB4-SS2	B-6	8-10	IN	AUGER BORING	M	Antimony	4.5	UNR	mg/kg	6
AB4-SS2	B-6	8-10	IN	AUGER BORING	M	Arsenic	16.3	NJ	mg/kg	1
AB4-SS2	B-6	8-10	IN	AUGER BORING	M	Beryllium	0.79		mg/kg	0.5
AB4-SS2	B-6	8-10	IN	AUGER BORING	M	Cadmium	0.45	B	mg/kg	0.5
AB4-SS2	B-6	8-10	IN	AUGER BORING	M	Chromium	10.0		mg/kg	1
AB4-SS2	B-6	8-10	IN	AUGER BORING	M	Copper	20.4		mg/kg	2.5
AB4-SS2	B-6	8-10	IN	AUGER BORING	M	Lead	20.3	*	mg/kg	0.3
AB4-SS2	B-6	8-10	IN	AUGER BORING	M	Mercury	0.050	U	mg/kg	0.1
AB4-SS2	B-6	8-10	IN	AUGER BORING	M	Nickel	27.0		mg/kg	4
AB4-SS2	B-6	8-10	IN	AUGER BORING	M	Selenium	0.35	BNWJ	mg/kg	0.5
AB4-SS2	B-6	8-10	IN	AUGER BORING	M	Silver	0.74	U	mg/kg	1
AB4-SS2	B-6	8-10	IN	AUGER BORING	M	Thallium	0.46	BNJ	mg/kg	1
AB4-SS2	B-6	8-10	IN	AUGER BORING	M	Zinc	90.3		mg/kg	2
AB5-SS1	C-2	3-5	IN	AUGER BORING	V	ALL VOLATILES	ND	NA	ug/kg	NA
AB5-SS1	C-2	3-5	IN	AUGER BORING	SV	ALL SEMI-VOLATILES	ND	NA	ug/kg	NA
AB5-SS1	C-2	3-5	IN	AUGER BORING	M	Antimony	4.5	UNR	mg/kg	6
AB5-SS1	C-2	3-5	IN	AUGER BORING	M	Arsenic	13.9	NJ	mg/kg	1
AB5-SS1	C-2	3-5	IN	AUGER BORING	M	Beryllium	0.67		mg/kg	0.5
AB5-SS1	C-2	3-5	IN	AUGER BORING	M	Cadmium	0.45	B	mg/kg	0.5
AB5-SS1	C-2	3-5	IN	AUGER BORING	M	Chromium	16.5		mg/kg	1
AB5-SS1	C-2	3-5	IN	AUGER BORING	M	Copper	29.4		mg/kg	2.5
AB5-SS1	C-2	3-5	IN	AUGER BORING	M	Lead	16.1		mg/kg	0.3
AB5-SS1	C-2	3-5	IN	AUGER BORING	M	Mercury	0.050	U	mg/kg	0.1
AB5-SS1	C-2	3-5	IN	AUGER BORING	M	Nickel	31.1		mg/kg	4
AB5-SS1	C-2	3-5	IN	AUGER BORING	M	Selenium	0.2	BNWJ	mg/kg	0.5
AB5-SS1	C-2	3-5	IN	AUGER BORING	M	Silver	0.74	U	mg/kg	1
AB5-SS1	C-2	3-5	IN	AUGER BORING	M	Thallium	0.53	BNJ	mg/kg	1
AB5-SS1	C-2	3-5	IN	AUGER BORING	M	Zinc	86.3		mg/kg	2

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – SOIL

SAMPLE #	GRID #	DEPTH	IN/OUT	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUALIFIER	UNITS	DETECTION LIMIT
AB5-SS2	C-2	8-10	IN	AUGER BORING	V	ALL VOLATILES	ND	NA	ug/kg	NA
AB5-SS2	C-2	8-10	IN	AUGER BORING	SV	ALL SEMI-VOLATILES	ND	NA	ug/kg	NA
AB5-SS2	C-2	8-10	IN	AUGER BORING	M	Antimony	4.5	UNR	mg/kg	6
AB5-SS2	C-2	8-10	IN	AUGER BORING	M	Arsenic	14.4	NJ	mg/kg	1
AB5-SS2	C-2	8-10	IN	AUGER BORING	M	Beryllium	0.33	B	mg/kg	0.5
AB5-SS2	C-2	8-10	IN	AUGER BORING	M	Cadmium	0.22	B	mg/kg	0.5
AB5-SS2	C-2	8-10	IN	AUGER BORING	M	Chromium	11.6		mg/kg	1
AB5-SS2	C-2	8-10	IN	AUGER BORING	M	Copper	27.1		mg/kg	2.5
AB5-SS2	C-2	8-10	IN	AUGER BORING	M	Lead	15.4		mg/kg	0.3
AB5-SS2	C-2	8-10	IN	AUGER BORING	M	Mercury	0.057	U	mg/kg	0.1
AB5-SS2	C-2	8-10	IN	AUGER BORING	M	Nickel	24.8		mg/kg	4
AB5-SS2	C-2	8-10	IN	AUGER BORING	M	Selenium	0.55	BNWJ	mg/kg	0.5
AB5-SS2	C-2	8-10	IN	AUGER BORING	M	Silver	0.74	U	mg/kg	1
AB5-SS2	C-2	8-10	IN	AUGER BORING	M	Thallium	0.38	BNJ	mg/kg	1
AB5-SS2	C-2	8-10	IN	AUGER BORING	M	Zinc	85.0		mg/kg	2
AB6-SS1	C-4	3-5	IN	AUGER BORING	V	ALL VOLATILES	ND	NA	ug/kg	NA
AB6-SS1	C-4	3-5	IN	AUGER BORING	SV	ALL SEMI-VOLATILES	ND	NA	ug/kg	NA
AB6-SS1	C-4	3-5	IN	AUGER BORING	M	Antimony	4.5	UNR	mg/kg	6
AB6-SS1	C-4	3-5	IN	AUGER BORING	M	Arsenic	22.2	NJ	mg/kg	1
AB6-SS1	C-4	3-5	IN	AUGER BORING	M	Beryllium	0.33	B	mg/kg	0.5
AB6-SS1	C-4	3-5	IN	AUGER BORING	M	Cadmium	3.3		mg/kg	0.5
AB6-SS1	C-4	3-5	IN	AUGER BORING	M	Chromium	16.5		mg/kg	1
AB6-SS1	C-4	3-5	IN	AUGER BORING	M	Copper	16.9		mg/kg	2.5
AB6-SS1	C-4	3-5	IN	AUGER BORING	M	Lead	19.5	*	mg/kg	0.3
AB6-SS1	C-4	3-5	IN	AUGER BORING	M	Mercury	0.058	U	mg/kg	0.1
AB6-SS1	C-4	3-5	IN	AUGER BORING	M	Nickel	25.2		mg/kg	4
AB6-SS1	C-4	3-5	IN	AUGER BORING	M	Selenium	0.29	BNWJ	mg/kg	0.5
AB6-SS1	C-4	3-5	IN	AUGER BORING	M	Silver	0.73	U	mg/kg	1
AB6-SS1	C-4	3-5	IN	AUGER BORING	M	Thallium	0.88	BNJ	mg/kg	1
AB6-SS1	C-4	3-5	IN	AUGER BORING	M	Zinc	83.1		mg/kg	2

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – SOIL

SAMPLE #	GRID #	DEPTH	IN/OUT	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUALIFIER	UNITS	DETECTION LIMIT
AB6-SS2	C-4	8-10	IN	AUGER BORING	V	Benzene	1	J	ug/kg	5
AB6-SS2	C-4	8-10	IN	AUGER BORING	SV	ALL SEMI-VOLATILES	ND	NA	ug/kg	NA
AB6-SS2	C-4	8-10	IN	AUGER BORING	M	Antimony	3.9	UNR	mg/kg	6
AB6-SS2	C-4	8-10	IN	AUGER BORING	M	Arsenic	20.3	NJ	mg/kg	1
AB6-SS2	C-4	8-10	IN	AUGER BORING	M	Beryllium	0.22	U	mg/kg	0.5
AB6-SS2	C-4	8-10	IN	AUGER BORING	M	Cadmium	0.49		mg/kg	0.5
AB6-SS2	C-4	8-10	IN	AUGER BORING	M	Chromium	12.4		mg/kg	1
AB6-SS2	C-4	8-10	IN	AUGER BORING	M	Copper	25.7		mg/kg	2.5
AB6-SS2	C-4	8-10	IN	AUGER BORING	M	Lead	14.0		mg/kg	0.3
AB6-SS2	C-4	8-10	IN	AUGER BORING	M	Mercury	0.06	U	mg/kg	0.1
AB6-SS2	C-4	8-10	IN	AUGER BORING	M	Nickel	20.3		mg/kg	4
AB6-SS2	C-4	8-10	IN	AUGER BORING	M	Selenium	0.53	BNWJ	mg/kg	0.5
AB6-SS2	C-4	8-10	IN	AUGER BORING	M	Silver	0.64	U	mg/kg	1
AB6-SS2	C-4	8-10	IN	AUGER BORING	M	Thallium	0.39	BNJ	mg/kg	1
AB6-SS2	C-4	8-10	IN	AUGER BORING	M	Zinc	85.7		mg/kg	2
AB7-SS1	C-7	3-5	OUT	AUGER BORING	V	Methylene Chloride	130	B	ug/kg	5
AB7-SS1	C-7	3-5	OUT	AUGER BORING	SV	ALL SEMI-VOLATILES	ND	NA	ug/kg	NA
AB7-SS1	C-7	3-5	OUT	AUGER BORING	M	Antimony	5.1	UNR	mg/kg	6
AB7-SS1	C-7	3-5	OUT	AUGER BORING	M	Arsenic	10.2	NJ	mg/kg	1
AB7-SS1	C-7	3-5	OUT	AUGER BORING	M	Beryllium	0.63		mg/kg	0.5
AB7-SS1	C-7	3-5	OUT	AUGER BORING	M	Cadmium	0.38	B	mg/kg	0.5
AB7-SS1	C-7	3-5	OUT	AUGER BORING	M	Chromium	17.8		mg/kg	1
AB7-SS1	C-7	3-5	OUT	AUGER BORING	M	Copper	30.8		mg/kg	2.5
AB7-SS1	C-7	3-5	OUT	AUGER BORING	M	Lead	17.6		mg/kg	0.3
AB7-SS1	C-7	3-5	OUT	AUGER BORING	M	Mercury	0.061	U	mg/kg	0.1
AB7-SS1	C-7	3-5	OUT	AUGER BORING	M	Nickel	35.8		mg/kg	4
AB7-SS1	C-7	3-5	OUT	AUGER BORING	M	Selenium	0.2	UNJ	mg/kg	0.5
AB7-SS1	C-7	3-5	OUT	AUGER BORING	M	Silver	0.83	U	mg/kg	1
AB7-SS1	C-7	3-5	OUT	AUGER BORING	M	Thallium	0.73	BNJ	mg/kg	1
AB7-SS1	C-7	3-5	OUT	AUGER BORING	M	Zinc	99.7		mg/kg	2

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – SOIL

SAMPLE #	GRID #	DEPTH	IN/OUT	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUAUFIER	UNITS	DETECTION LIMIT
AB7-SS2	C-7	8-10	OUT	AUGER BORING	V	ALL VOLATILES	ND	NA	ug/kg	NA
AB7-SS2	C-7	8-10	OUT	AUGER BORING	SV	ALL SEMI-VOLATILES	ND	NA	ug/kg	NA
AB7-SS2	C-7	8-10	OUT	AUGER BORING	M	Antimony	4.4	UNR	mg/kg	6
AB7-SS2	C-7	8-10	OUT	AUGER BORING	M	Arsenic	21	NJ	mg/kg	1
AB7-SS2	C-7	8-10	OUT	AUGER BORING	M	Beryllium	0.33	B	mg/kg	0.5
AB7-SS2	C-7	8-10	OUT	AUGER BORING	M	Cadmium	0.55		mg/kg	0.5
AB7-SS2	C-7	8-10	OUT	AUGER BORING	M	Chromium	11.5		mg/kg	1
AB7-SS2	C-7	8-10	OUT	AUGER BORING	M	Copper	23.0		mg/kg	2.5
AB7-SS2	C-7	8-10	OUT	AUGER BORING	M	Lead	16.7		mg/kg	0.3
AB7-SS2	C-7	8-10	OUT	AUGER BORING	M	Mercury	0.057	U	mg/kg	0.1
AB7-SS2	C-7	8-10	OUT	AUGER BORING	M	Nickel	25.7		mg/kg	4
AB7-SS2	C-7	8-10	OUT	AUGER BORING	M	Selenium	0.34	BNWJ	mg/kg	0.5
AB7-SS2	C-7	8-10	OUT	AUGER BORING	M	Silver	0.72	U	mg/kg	1
AB7-SS2	C-7	8-10	OUT	AUGER BORING	M	Thallium	0.54	BNJ	mg/kg	1
AB7-SS2	C-7	8-10	OUT	AUGER BORING	M	Zinc	82.9		mg/kg	2
AB8-SS1	D-2	3-5	IN	AUGER BORING	V	ALL VOLATILES	ND	NA	ug/kg	NA
AB8-SS1	D-2	3-5	IN	AUGER BORING	SV	ALL SEMI-VOLATILES	ND	NA	ug/kg	NA
AB8-SS1	D-2	3-5	IN	AUGER BORING	M	Antimony	4.5	UNR	mg/kg	6
AB8-SS1	D-2	3-5	IN	AUGER BORING	M	Arsenic	16.0	NJ	mg/kg	1
AB8-SS1	D-2	3-5	IN	AUGER BORING	M	Beryllium	0.45	B	mg/kg	0.5
AB8-SS1	D-2	3-5	IN	AUGER BORING	M	Cadmium	0.60		mg/kg	0.5
AB8-SS1	D-2	3-5	IN	AUGER BORING	M	Chromium	13.6		mg/kg	1
AB8-SS1	D-2	3-5	IN	AUGER BORING	M	Copper	20		mg/kg	2.5
AB8-SS1	D-2	3-5	IN	AUGER BORING	M	Lead	15.7		mg/kg	0.3
AB8-SS1	D-2	3-5	IN	AUGER BORING	M	Mercury	0.057	U	mg/kg	0.1
AB8-SS1	D-2	3-5	IN	AUGER BORING	M	Nickel	30		mg/kg	4
AB8-SS1	D-2	3-5	IN	AUGER BORING	M	Selenium	0.25	BNWJ	mg/kg	0.5
AB8-SS1	D-2	3-5	IN	AUGER BORING	M	Silver	0.74	U	mg/kg	1
AB8-SS1	D-2	3-5	IN	AUGER BORING	M	Thallium	0.63	BNJ	mg/kg	1
AB8-SS1	D-2	3-5	IN	AUGER BORING	M	Zinc	82.2		mg/kg	2

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – SOIL

SAMPLE #	GRID #	DEPTH	IN/OUT	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUALIFIER	UNITS	DETECTION LIMIT
AB8-SS2	D-2	8-10	IN	AUGER BORING	V	ALL VOLATILES	ND	NA	ug/kg	NA
AB8-SS2	D-2	8-10	IN	AUGER BORING	SV	ALL SEMI-VOLATILES	ND	NA	ug/kg	NA
AB8-SS2	D-2	8-10	IN	AUGER BORING	M	Antimony	5	UNR	mg/kg	6
AB8-SS2	D-2	8-10	IN	AUGER BORING	M	Arsenic	17.4	NJ	mg/kg	1
AB8-SS2	D-2	8-10	IN	AUGER BORING	M	Beryllium	0.37	B	mg/kg	0.5
AB8-SS2	D-2	8-10	IN	AUGER BORING	M	Cadmium	0.37	B	mg/kg	0.5
AB8-SS2	D-2	8-10	IN	AUGER BORING	M	Chromium	15.9		mg/kg	1
AB8-SS2	D-2	8-10	IN	AUGER BORING	M	Copper	30.2		mg/kg	2.5
AB8-SS2	D-2	8-10	IN	AUGER BORING	M	Lead	14.9		mg/kg	0.3
AB8-SS2	D-2	8-10	IN	AUGER BORING	M	Mercury	0.059	U	mg/kg	0.1
AB8-SS2	D-2	8-10	IN	AUGER BORING	M	Nickel	22.2		mg/kg	4
AB8-SS2	D-2	8-10	IN	AUGER BORING	M	Selenium	0.35	BNWJ	mg/kg	0.5
AB8-SS2	D-2	8-10	IN	AUGER BORING	M	Silver	0.82	U	mg/kg	1
AB8-SS2	D-2	8-10	IN	AUGER BORING	M	Thallium	0.46	BNJ	mg/kg	1
AB8-SS2	D-2	8-10	IN	AUGER BORING	M	Zinc	93.7		mg/kg	2
AB9-SS1	D-4	3-5	IN	AUGER BORING	V	ALL VOLATILES	ND	NA	ug/kg	NA
AB9-SS1	D-4	3-5	IN	AUGER BORING	SV	ALL SEMI-VOLATILES	ND	NA	ug/kg	NA
AB9-SS1	D-4	3-5	IN	AUGER BORING	M	Antimony	4.9	UNR	mg/kg	6
AB9-SS1	D-4	3-5	IN	AUGER BORING	M	Arsenic	20.7	NJ	mg/kg	1
AB9-SS1	D-4	3-5	IN	AUGER BORING	M	Beryllium	0.49	B	mg/kg	0.5
AB9-SS1	D-4	3-5	IN	AUGER BORING	M	Cadmium	0.49	B	mg/kg	0.5
AB9-SS1	D-4	3-5	IN	AUGER BORING	M	Chromium	16.9		mg/kg	1
AB9-SS1	D-4	3-5	IN	AUGER BORING	M	Copper	27.7		mg/kg	2.5
AB9-SS1	D-4	3-5	IN	AUGER BORING	M	Lead	27.7	S	mg/kg	0.3
AB9-SS1	D-4	3-5	IN	AUGER BORING	M	Mercury	0.06	U	mg/kg	0.1
AB9-SS1	D-4	3-5	IN	AUGER BORING	M	Nickel	30.6		mg/kg	4
AB9-SS1	D-4	3-5	IN	AUGER BORING	M	Selenium	0.21	UNJ	mg/kg	0.5
AB9-SS1	D-4	3-5	IN	AUGER BORING	M	Silver	0.01	U	mg/kg	1
AB9-SS1	D-4	3-5	IN	AUGER BORING	M	Thallium	0.48	BNJ	mg/kg	1
AB9-SS1	D-4	3-5	IN	AUGER BORING	M	Zinc	97.2		mg/kg	2

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – SOIL

SAMPLE #	GRID #	DEPTH	IN/OUT	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUALIFIER	UNITS	DETECTION LIMIT
AB9-SS2	D-4	0-10	IN	AUGER BORING	V	ALL VOLATILES	ND	NA	ug/kg	NA
AB9-SS2	D-4	0-10	IN	AUGER BORING	SV	ALL SEMI-VOLATILES	ND	NA	ug/kg	NA
AB9-SS2	D-4	0-10	IN	AUGER BORING	M	Antimony	6	BNJ	mg/kg	6
AB9-SS2	D-4	0-10	IN	AUGER BORING	M	Arsenic	16.1	NJ	mg/kg	1
AB9-SS2	D-4	0-10	IN	AUGER BORING	M	Beryllium	0.64		mg/kg	0.5
AB9-SS2	D-4	0-10	IN	AUGER BORING	M	Cadmium	0.51	B	mg/kg	0.5
AB9-SS2	D-4	0-10	IN	AUGER BORING	M	Chromium	17.3		mg/kg	1
AB9-SS2	D-4	0-10	IN	AUGER BORING	M	Copper	24.9		mg/kg	2.5
AB9-SS2	D-4	0-10	IN	AUGER BORING	M	Lead	19.5		mg/kg	0.3
AB9-SS2	D-4	0-10	IN	AUGER BORING	M	Mercury	0.06	U	mg/kg	0.1
AB9-SS2	D-4	0-10	IN	AUGER BORING	M	Nickel	30.7		mg/kg	4
AB9-SS2	D-4	0-10	IN	AUGER BORING	M	Selenium	0.21	UNJ	mg/kg	0.5
AB9-SS2	D-4	0-10	IN	AUGER BORING	M	Silver	0.84	U	mg/kg	1
AB9-SS2	D-4	0-10	IN	AUGER BORING	M	Thallium	0.74	BNJ	mg/kg	1
AB9-SS2	D-4	0-10	IN	AUGER BORING	M	Zinc	90.9		mg/kg	2
AB10-SS1	D-5	3-5	IN	AUGER BORING	V	ALL VOLATILES	ND	NA	ug/kg	NA
AB10-SS1	D-5	3-5	IN	AUGER BORING	SV	ALL SEMI-VOLATILES	ND	NA	ug/kg	NA
AB10-SS1	D-5	3-5	IN	AUGER BORING	M	Antimony	4.7	UNR	mg/kg	6
AB10-SS1	D-5	3-5	IN	AUGER BORING	M	Arsenic	21	NJ	mg/kg	1
AB10-SS1	D-5	3-5	IN	AUGER BORING	M	Beryllium	0.50		mg/kg	0.5
AB10-SS1	D-5	3-5	IN	AUGER BORING	M	Cadmium	0.35	B	mg/kg	0.5
AB10-SS1	D-5	3-5	IN	AUGER BORING	M	Chromium	17.0		mg/kg	1
AB10-SS1	D-5	3-5	IN	AUGER BORING	M	Copper	29.4		mg/kg	2.5
AB10-SS1	D-5	3-5	IN	AUGER BORING	M	Lead	17.6		mg/kg	0.3
AB10-SS1	D-5	3-5	IN	AUGER BORING	M	Mercury	0.06	U	mg/kg	0.1
AB10-SS1	D-5	3-5	IN	AUGER BORING	M	Nickel	28.6		mg/kg	4
AB10-SS1	D-5	3-5	IN	AUGER BORING	M	Selenium	0.19	UNJ	mg/kg	0.5
AB10-SS1	D-5	3-5	IN	AUGER BORING	M	Silver	0.76	U	mg/kg	1
AB10-SS1	D-5	3-5	IN	AUGER BORING	M	Thallium	0.56	BNJ	mg/kg	1
AB10-SS1	D-5	3-5	IN	AUGER BORING	M	Zinc	90.5		mg/kg	2

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – SOIL

SAMPLE #	GRID #	DEPTH	IN/OUT	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUALIFIER	UNITS	DETECTION LIMIT
AB12–SS7	C–5	21–23	IN	AUGER BORING	V	o–Xylene	6	J	ug/kg	5
AB12–SS7	C–5	21–23	IN	AUGER BORING	V	1,3–Dichlorobenzene	6	J	ug/kg	5
AB12–SS7	C–5	21–23	IN	AUGER BORING	V	1,2/1,4–Dichlorobenzene	6	J	ug/kg	5
AB12–SS7	C–5	21–23	IN	AUGER BORING	SV	ALL SEMI–VOLATILES	ND	NA	ug/kg	NA
AB12–SS7	C–5	21–23	IN	AUGER BORING	M	Antimony	3.9	UNJ	mg/kg	6
AB12–SS7	C–5	21–23	IN	AUGER BORING	M	Arsenic	0.6	B	mg/kg	1
AB12–SS7	C–5	21–23	IN	AUGER BORING	M	Beryllium	0.30	B	mg/kg	0.5
AB12–SS7	C–5	21–23	IN	AUGER BORING	M	Cadmium	0.10	U	mg/kg	0.5
AB12–SS7	C–5	21–23	IN	AUGER BORING	M	Chromium	0.5	•	mg/kg	1
AB12–SS7	C–5	21–23	IN	AUGER BORING	M	Copper	21.7	NJ	mg/kg	2.5
AB12–SS7	C–5	21–23	IN	AUGER BORING	M	Lead	14.1	N*J	mg/kg	0.3
AB12–SS7	C–5	21–23	IN	AUGER BORING	M	Mercury	0.064	U	mg/kg	0.1
AB12–SS7	C–5	21–23	IN	AUGER BORING	M	Nickel	14.5		mg/kg	4
AB12–SS7	C–5	21–23	IN	AUGER BORING	M	Selenium	0.26	BW	mg/kg	0.5
AB12–SS7	C–5	21–23	IN	AUGER BORING	M	Silver	0.63	U	mg/kg	1
AB12–SS7	C–5	21–23	IN	AUGER BORING	M	Thallium	0.12	BNWJ	mg/kg	1
AB12–SS7	C–5	21–23	IN	AUGER BORING	M	Zinc	32.0	NJ	mg/kg	2

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – SOIL

SAMPLE #	GRID #	DEPTH	IN/OUT	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUALIFIER	UNITS	DETECTION LIMIT
AB13-SS5	C-3	17-19	IN	AUGER BORING	V	ALL VOLATILES	ND	NA	ug/kg	NA
AB13-SS5	C-3	17-19	IN	AUGER BORING	SV	ALL SEMI-VOLATILES	ND	NA	ug/kg	NA
AB13-SS5	C-3	17-19	IN	AUGER BORING	M	Antimony	4.2	UNJ	mg/kg	6
AB13-SS5	C-3	17-19	IN	AUGER BORING	M	Arsenic	5.8	B	mg/kg	1
AB13-SS5	C-3	17-19	IN	AUGER BORING	M	Beryllium	0.31	B	mg/kg	0.5
AB13-SS5	C-3	17-19	IN	AUGER BORING	M	Cadmium	0.2	U	mg/kg	0.5
AB13-SS5	C-3	17-19	IN	AUGER BORING	M	Chromium	6.7		mg/kg	1
AB13-SS5	C-3	17-19	IN	AUGER BORING	M	Copper	42.8	NJ	mg/kg	2.5
AB13-SS5	C-3	17-19	IN	AUGER BORING	M	Lead	10.2	N*J	mg/kg	0.3
AB13-SS5	C-3	17-19	IN	AUGER BORING	M	Mercury	0.17		mg/kg	0.1
AB13-SS5	C-3	17-19	IN	AUGER BORING	M	Nickel	8.6		mg/kg	4
AB13-SS5	C-3	17-19	IN	AUGER BORING	M	Selenium	0.32	BW	mg/kg	0.5
AB13-SS5	C-3	17-19	IN	AUGER BORING	M	Silver	0.69	U	mg/kg	1
AB13-SS5	C-3	17-19	IN	AUGER BORING	M	Thallium	0.11	UNWJ	mg/kg	1
AB13-SS5	C-3	17-19	IN	AUGER BORING	M	Zinc	47.9	NJ	mg/kg	2
AB13-SS7	C-3	21-23	IN	AUGER BORING	V	ALL VOLATILES	ND	NA	ug/kg	NA
AB13-SS7	C-3	21-23	IN	AUGER BORING	SV	ALL SEMI-VOLATILES	ND	NA	ug/kg	NA
AB13-SS7	C-3	21-23	IN	AUGER BORING	M	Antimony	1.8	UNJ	mg/kg	6
AB13-SS7	C-3	21-23	IN	AUGER BORING	M	Arsenic	9.5		mg/kg	1
AB13-SS7	C-3	21-23	IN	AUGER BORING	M	Beryllium	0.10	B	mg/kg	0.5
AB13-SS7	C-3	21-23	IN	AUGER BORING	M	Cadmium	0.088	B	mg/kg	0.5
AB13-SS7	C-3	21-23	IN	AUGER BORING	M	Chromium	4.8		mg/kg	1
AB13-SS7	C-3	21-23	IN	AUGER BORING	M	Copper	42.9	NJ	mg/kg	2.5
AB13-SS7	C-3	21-23	IN	AUGER BORING	M	Lead	10.1	N*J	mg/kg	0.3
AB13-SS7	C-3	21-23	IN	AUGER BORING	M	Mercury	0.053	U	mg/kg	0.1
AB13-SS7	C-3	21-23	IN	AUGER BORING	M	Nickel	8.8		mg/kg	4
AB13-SS7	C-3	21-23	IN	AUGER BORING	M	Selenium	0.24	B	mg/kg	0.5
AB13-SS7	C-3	21-23	IN	AUGER BORING	M	Silver	0.29	U	mg/kg	1
AB13-SS7	C-3	21-23	IN	AUGER BORING	M	Thallium	0.085	UNW	mg/kg	1
AB13-SS7	C-3	21-23	IN	AUGER BORING	M	Zinc	65.1	NJ	mg/kg	2

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – SOIL

SAMPLE #	GRID #	DEPTH	IN/OUT	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUALIFIER	UNITS	DETECTION LIMIT
AB14-SS2	C-6	0-10	IN	AUGER BORING	V	Benzene	15000		ug/kg	5
AB14-SS2	C-6	0-10	IN	AUGER BORING	V	Ethylbenzene	15000		ug/kg	5
AB14-SS2	C-6	0-10	IN	AUGER BORING	V	m/p-Xylene	15000		ug/kg	5
AB14-SS2	C-6	0-10	IN	AUGER BORING	V	o-Xylene	27000		ug/kg	5
AB14-SS2	C-6	0-10	IN	AUGER BORING	SV	Naphthalene	460		ug/kg	330
AB14-SS2	C-6	0-10	IN	AUGER BORING	SV	2-Methylnaphthalene	590		ug/kg	330
AB14-SS2	C-6	0-10	IN	AUGER BORING	SV	Di-n-Butyl Phthalate	120	J	ug/kg	330
AB14-SS2	C-6	0-10	IN	AUGER BORING	M	Antimony	3.3	UNJ	mg/kg	6
AB14-SS2	C-6	0-10	IN	AUGER BORING	M	Arsenic	16.9		mg/kg	1
AB14-SS2	C-6	0-10	IN	AUGER BORING	M	Beryllium	0.66		mg/kg	0.5
AB14-SS2	C-6	0-10	IN	AUGER BORING	M	Cadmium	0.25	B	mg/kg	0.5
AB14-SS2	C-6	0-10	IN	AUGER BORING	M	Chromium	13.9		mg/kg	1
AB14-SS2	C-6	0-10	IN	AUGER BORING	M	Copper	33.5	NJ	mg/kg	2.5
AB14-SS2	C-6	0-10	IN	AUGER BORING	M	Lead	19.6	N*J	mg/kg	0.3
AB14-SS2	C-6	0-10	IN	AUGER BORING	M	Mercury	0.057	U	mg/kg	0.1
AB14-SS2	C-6	0-10	IN	AUGER BORING	M	Nickel	31.0		mg/kg	4
AB14-SS2	C-6	0-10	IN	AUGER BORING	M	Selenium	0.3	BW	mg/kg	0.5
AB14-SS2	C-6	0-10	IN	AUGER BORING	M	Silver	0.55	U	mg/kg	1
AB14-SS2	C-6	0-10	IN	AUGER BORING	M	Thallium	0.29	BNWJ	mg/kg	1
AB14-SS2	C-6	0-10	IN	AUGER BORING	M	Zinc	82.7	NJ	mg/kg	2
AB14-SS7	C-6	21-25	IN	AUGER BORING	V	Benzene	6		ug/kg	5
AB14-SS7	C-6	21-25	IN	AUGER BORING	SV	ALL SEMI-VOLATILES	ND	NA	ug/kg	NA
AB14-SS7	C-6	21-25	IN	AUGER BORING	M	Antimony	3.2	UNJ	mg/kg	6
AB14-SS7	C-6	21-25	IN	AUGER BORING	M	Arsenic	61.2		mg/kg	1
AB14-SS7	C-6	21-25	IN	AUGER BORING	M	Beryllium	0.32	· B	mg/kg	0.5
AB14-SS7	C-6	21-25	IN	AUGER BORING	M	Cadmium	0.16	B	mg/kg	0.5
AB14-SS7	C-6	21-25	IN	AUGER BORING	M	Chromium	9.4		mg/kg	1
AB14-SS7	C-6	21-25	IN	AUGER BORING	M	Copper	40	NJ	mg/kg	2.5
AB14-SS7	C-6	21-25	IN	AUGER BORING	M	Lead	22.9	N*J	mg/kg	0.3
AB14-SS7	C-6	21-25	IN	AUGER BORING	M	Mercury	0.055	U	mg/kg	0.1
AB14-SS7	C-6	21-25	IN	AUGER BORING	M	Nickel	15.3		mg/kg	4
AB14-SS7	C-6	21-25	IN	AUGER BORING	M	Selenium	0.6	W	mg/kg	0.5
AB14-SS7	C-6	21-25	IN	AUGER BORING	M	Silver	0.53	U	mg/kg	1
AB14-SS7	C-6	21-25	IN	AUGER BORING	M	Thallium	0.09	UNW	mg/kg	1
AB14-SS7	C-6	21-25	IN	AUGER BORING	M	Zinc	73.6	NJ	mg/kg	2

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – SOIL

SAMPLE #	GRID #	DEPTH	IN/OUT	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUALIFIER	UNITS	DETECTION LIMIT
AB15-SS3	D-5	13-15	IN	AUGER BORING	V	Acetone	640		ug/kg	100
AB15-SS3	D-5	13-15	IN	AUGER BORING	V	Ethylbenzene	250		ug/kg	5
AB15-SS3	D-5	13-15	IN	AUGER BORING	SV	ALL SEMI-VOLATILES	ND	NA	ug/kg	NA
AB15-SS3	D-5	13-15	IN	AUGER BORING	M	Antimony	4.9	UNJ	mg/kg	6
AB15-SS3	D-5	13-15	IN	AUGER BORING	M	Arsenic	14.8		mg/kg	1
AB15-SS3	D-5	13-15	IN	AUGER BORING	M	Beryllium	0.73		mg/kg	0.5
AB15-SS3	D-5	13-15	IN	AUGER BORING	M	Cadmium	0.23	U	mg/kg	0.5
AB15-SS3	D-5	13-15	IN	AUGER BORING	M	Chromium	10.2		mg/kg	1
AB15-SS3	D-5	13-15	IN	AUGER BORING	M	Copper	23.7	NJ	mg/kg	2.5
AB15-SS3	D-5	13-15	IN	AUGER BORING	M	Lead	15.8	N*J	mg/kg	0.3
AB15-SS3	D-5	13-15	IN	AUGER BORING	M	Mercury	0.096	B	mg/kg	0.1
AB15-SS3	D-5	13-15	IN	AUGER BORING	M	Nickel	27.2		mg/kg	4
AB15-SS3	D-5	13-15	IN	AUGER BORING	M	Selenium	0.21	UW	mg/kg	0.5
AB15-SS3	D-5	13-15	IN	AUGER BORING	M	Silver	0.8	U	mg/kg	1
AB15-SS3	D-5	13-15	IN	AUGER BORING	M	Thallium	0.11	UNW	mg/kg	1
AB15-SS3	D-5	13-15	IN	AUGER BORING	M	Zinc	76.8	NJ	mg/kg	2
AB15-SS0	D-5	25-27	IN	AUGER BORING	V	Trichloroethane	4	J	ug/kg	5
AB15-SS0	D-5	25-27	IN	AUGER BORING	SV	ALL SEMI-VOLATILES	ND	NA	ug/kg	NA
AB15-SS0	D-5	25-27	IN	AUGER BORING	M	Antimony	2.6	UNJ	mg/kg	6
AB15-SS0	D-5	25-27	IN	AUGER BORING	M	Arsenic	14.5		mg/kg	1
AB15-SS0	D-5	25-27	IN	AUGER BORING	M	Beryllium	0.72		mg/kg	0.5
AB15-SS0	D-5	25-27	IN	AUGER BORING	M	Cadmium	0.13	B	mg/kg	0.5
AB15-SS0	D-5	25-27	IN	AUGER BORING	M	Chromium	10.4		mg/kg	1
AB15-SS0	D-5	25-27	IN	AUGER BORING	M	Copper	19.9	NJ	mg/kg	2.5
AB15-SS0	D-5	25-27	IN	AUGER BORING	M	Lead	13.2	N*J	mg/kg	0.3
AB15-SS0	D-5	25-27	IN	AUGER BORING	M	Mercury	0.16		mg/kg	0.1
AB15-SS0	D-5	25-27	IN	AUGER BORING	M	Nickel	30.3		mg/kg	4
AB15-SS0	D-5	25-27	IN	AUGER BORING	M	Selenium	0.31	BW	mg/kg	0.5
AB15-SS0	D-5	25-27	IN	AUGER BORING	M	Silver	0.43	U	mg/kg	1
AB15-SS0	D-5	25-27	IN	AUGER BORING	M	Thallium	0.094	UNW	mg/kg	1
AB15-SS0	D-5	25-27	IN	AUGER BORING	M	Zinc	60.8	NJ	mg/kg	2

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – SOIL

SAMPLE #	GRID #	DEPTH	IN/OUT	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUALIFIER	UNITS	DETECTION LIMIT
MW4-SS2	B-1	0-10	OUT	MONITORING WELL	V	ALL VOLATILES	ND	NA	ug/kg	NA
MW4-SS2	B-1	0-10	OUT	MONITORING WELL	SV	ALL SEMI-VOLATILES	ND	NA	ug/kg	NA
MW4-SS2	B-1	0-10	OUT	MONITORING WELL	M	Antimony	3.2	UNJ	mg/kg	6
MW4-SS2	B-1	0-10	OUT	MONITORING WELL	M	Arsenic	17.4		mg/kg	1
MW4-SS2	B-1	0-10	OUT	MONITORING WELL	M	Beryllium	0.39		mg/kg	0.5
MW4-SS2	B-1	0-10	OUT	MONITORING WELL	M	Cadmium	0.24	B	mg/kg	0.5
MW4-SS2	B-1	0-10	OUT	MONITORING WELL	M	Chromium	9.1		mg/kg	1
MW4-SS2	B-1	0-10	OUT	MONITORING WELL	M	Copper	20.7	NJ	mg/kg	2.5
MW4-SS2	B-1	0-10	OUT	MONITORING WELL	M	Lead	15.7	N*J	mg/kg	0.3
MW4-SS2	B-1	0-10	OUT	MONITORING WELL	M	Mercury	0.057	U	mg/kg	0.1
MW4-SS2	B-1	0-10	OUT	MONITORING WELL	M	Nickel	24		mg/kg	4
MW4-SS2	B-1	0-10	OUT	MONITORING WELL	M	Selenium	0.10	BW	mg/kg	0.5
MW4-SS2	B-1	0-10	OUT	MONITORING WELL	M	Silver	0.52	U	mg/kg	1
MW4-SS2	B-1	0-10	OUT	MONITORING WELL	M	Thallium	0.34	BNWJ	mg/kg	1
MW4-SS2	B-1	0-10	OUT	MONITORING WELL	M	Zinc	81	NJ	mg/kg	2
MW4-SS3	B-1	13-15	OUT	MONITORING WELL	V	ALL VOLATILES	ND	NA	ug/kg	NA
MW4-SS3	B-1	13-15	OUT	MONITORING WELL	SV	ALL SEMI-VOLATILES	ND	NA	ug/kg	NA
MW4-SS3	B-1	13-15	OUT	MONITORING WELL	M	Antimony	3.4	UNJ	mg/kg	6
MW4-SS3	B-1	13-15	OUT	MONITORING WELL	M	Arsenic	9.1		mg/kg	1
MW4-SS3	B-1	13-15	OUT	MONITORING WELL	M	Beryllium	0.43		mg/kg	0.5
MW4-SS3	B-1	13-15	OUT	MONITORING WELL	M	Cadmium	0.60		mg/kg	0.5
MW4-SS3	B-1	13-15	OUT	MONITORING WELL	M	Chromium	11.2		mg/kg	1
MW4-SS3	B-1	13-15	OUT	MONITORING WELL	M	Copper	19.7	NJ	mg/kg	2.5
MW4-SS3	B-1	13-15	OUT	MONITORING WELL	M	Lead	15.1	N*J	mg/kg	0.3
MW4-SS3	B-1	13-15	OUT	MONITORING WELL	M	Mercury	0.057	U	mg/kg	0.1
MW4-SS3	B-1	13-15	OUT	MONITORING WELL	M	Nickel	25.2		mg/kg	4
MW4-SS3	B-1	13-15	OUT	MONITORING WELL	M	Selenium	0.57	W	mg/kg	0.5
MW4-SS3	B-1	13-15	OUT	MONITORING WELL	M	Silver	0.56	U	mg/kg	1
MW4-SS3	B-1	13-15	OUT	MONITORING WELL	M	Thallium	0.27	BNWJ	mg/kg	1
MW4-SS3	B-1	13-15	OUT	MONITORING WELL	M	Zinc	91.1	NJ	mg/kg	2

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – SOIL

SAMPLE #	GRID #	DEPTH	IN/OUT	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUALIFIER	UNITS	DETECTION LIMIT
MW5-SS2	B-4	8-10	IN	MONITORING WELL	V	ALL VOLATILES	ND	NA	ug/kg	NA
MW5-SS2	B-4	8-10	IN	MONITORING WELL	SV	ALL SEMI-VOLATILES	ND	NA	ug/kg	NA
MW5-SS2	B-4	8-10	IN	MONITORING WELL	M	Antimony	4.5	UNR	mg/kg	6
MW5-SS2	B-4	8-10	IN	MONITORING WELL	M	Arsenic	26	NJ	mg/kg	1
MW5-SS2	B-4	8-10	IN	MONITORING WELL	M	Beryllium	0.57		mg/kg	0.5
MW5-SS2	B-4	8-10	IN	MONITORING WELL	M	Cadmium	0.23	B	mg/kg	0.5
MW5-SS2	B-4	8-10	IN	MONITORING WELL	M	Chromium	16.5		mg/kg	1
MW5-SS2	B-4	8-10	IN	MONITORING WELL	M	Copper	26.2	*	mg/kg	2.5
MW5-SS2	B-4	8-10	IN	MONITORING WELL	M	Lead	18.0	NSJ	mg/kg	0.3
MW5-SS2	B-4	8-10	IN	MONITORING WELL	M	Mercury	0.055	U	mg/kg	0.1
MW5-SS2	B-4	8-10	IN	MONITORING WELL	M	Nickel	26	*	mg/kg	4
MW5-SS2	B-4	8-10	IN	MONITORING WELL	M	Selenium	0.51	N+J	mg/kg	0.5
MW5-SS2	B-4	8-10	IN	MONITORING WELL	M	Silver	0.75	U	mg/kg	1
MW5-SS2	B-4	8-10	IN	MONITORING WELL	M	Thallium	0.31	B	mg/kg	1
MW5-SS2	B-4	8-10	IN	MONITORING WELL	M	Zinc	82		mg/kg	2
MW5-SS3	B-4	13-15	IN	MONITORING WELL	V	Ethylbenzene	7400		ug/kg	5
MW5-SS3	B-4	13-15	IN	MONITORING WELL	V	m/p-Xylene	1900		ug/kg	5
MW5-SS3	B-4	13-15	IN	MONITORING WELL	V	o-Xylene	7000		ug/kg	5
MW5-SS3	B-4	13-15	IN	MONITORING WELL	SV	Naphthalene	160	J	ug/kg	330
MW5-SS3	B-4	13-15	IN	MONITORING WELL	SV	2-Methylnaphthalene	460		ug/kg	330
MW5-SS3	B-4	13-15	IN	MONITORING WELL	M	Antimony	4.2	UNR	mg/kg	6
MW5-SS3	B-4	13-15	IN	MONITORING WELL	M	Arsenic	8.3	NJ	mg/kg	1
MW5-SS3	B-4	13-15	IN	MONITORING WELL	M	Beryllium	0.32	B	mg/kg	0.5
MW5-SS3	B-4	13-15	IN	MONITORING WELL	M	Cadmium	0.21	B	mg/kg	0.5
MW5-SS3	B-4	13-15	IN	MONITORING WELL	M	Chromium	9.0		mg/kg	1
MW5-SS3	B-4	13-15	IN	MONITORING WELL	M	Copper	57.4	*	mg/kg	2.5
MW5-SS3	B-4	13-15	IN	MONITORING WELL	M	Lead	17.6	NJ	mg/kg	0.3
MW5-SS3	B-4	13-15	IN	MONITORING WELL	M	Mercury	0.058	U	mg/kg	0.1
MW5-SS3	B-4	13-15	IN	MONITORING WELL	M	Nickel	13.7		mg/kg	4
MW5-SS3	B-4	13-15	IN	MONITORING WELL	M	Selenium	0.10	BNSJ	mg/kg	0.5
MW5-SS3	B-4	13-15	IN	MONITORING WELL	M	Silver	0.7	U	mg/kg	1
MW5-SS3	B-4	13-15	IN	MONITORING WELL	M	Thallium	0.050	U	mg/kg	1
MW5-SS3	B-4	13-15	IN	MONITORING WELL	M	Zinc	65.0		mg/kg	2

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – SOIL

SAMPLE #	GRID #	DEPTH	IN/OUT	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUALIFIER	UNITS	DETECTION LIMIT
MW6-SS2	E-5	0-10	OUT	MONITORING WELL	V	ALL VOLATILES	ND	NA	ug/kg	NA
MW6-SS2	E-5	0-10	OUT	MONITORING WELL	SV	ALL SEMI-VOLATILES	ND	NA	ug/kg	NA
MW6-SS2	E-5	0-10	OUT	MONITORING WELL	M	Antimony	4.4	UNR	mg/kg	6
MW6-SS2	E-5	8-10	OUT	MONITORING WELL	M	Arsenic	19.6	NJ	mg/kg	1
MW6-SS2	E-5	0-10	OUT	MONITORING WELL	M	Beryllium	0.54		mg/kg	0.5
MW6-SS2	E-5	0-10	OUT	MONITORING WELL	M	Cadmium	0.33	B	mg/kg	0.5
MW6-SS2	E-5	0-10	OUT	MONITORING WELL	M	Chromium	10		mg/kg	1
MW6-SS2	E-5	0-10	OUT	MONITORING WELL	M	Copper	29.9	*	mg/kg	2.5
MW6-SS2	E-5	0-10	OUT	MONITORING WELL	M	Lead	10.7	NSJ	mg/kg	0.3
MW6-SS2	E-5	0-10	OUT	MONITORING WELL	M	Mercury	0.057	U	mg/kg	0.1
MW6-SS2	E-5	0-10	OUT	MONITORING WELL	M	Nickel	28.8		mg/kg	4
MW6-SS2	E-5	0-10	OUT	MONITORING WELL	M	Selenium	0.79	N+J	mg/kg	0.5
MW6-SS2	E-5	0-10	OUT	MONITORING WELL	M	Silver	0.72	U	mg/kg	1
MW6-SS2	E-5	0-10	OUT	MONITORING WELL	M	Thallium	0.29	B	mg/kg	1
MW6-SS2	E-5	0-10	OUT	MONITORING WELL	M	Zinc	82.0		mg/kg	2
MW6-SS3	E-5	13-15	OUT	MONITORING WELL	V	Vinyl Chloride	59		ug/kg	10
MW6-SS3	E-5	13-15	OUT	MONITORING WELL	V	1,1-Dichloroethene	2	J	ug/kg	5
MW6-SS3	E-5	13-15	OUT	MONITORING WELL	V	trans-1,2-Dichloroethene	1000	D	ug/kg	5
MW6-SS3	E-5	13-15	OUT	MONITORING WELL	V	Trichloroethene	40		ug/kg	5
MW6-SS3	E-5	13-15	OUT	MONITORING WELL	V	Toluene	1	J	ug/kg	5
MW6-SS3	E-5	13-15	OUT	MONITORING WELL	SV	ALL SEMI-VOLATILES	ND	NA	ug/kg	NA
MW6-SS3	E-5	13-15	OUT	MONITORING WELL	M	Antimony	3.9	UNR	mg/kg	6
MW6-SS3	E-5	13-15	OUT	MONITORING WELL	M	Arsenic	11.3	NJ	mg/kg	1
MW6-SS3	E-5	13-15	OUT	MONITORING WELL	M	Beryllium	0.49		mg/kg	0.5
MW6-SS3	E-5	13-15	OUT	MONITORING WELL	M	Cadmium	0.2	B	mg/kg	0.5
MW6-SS3	E-5	13-15	OUT	MONITORING WELL	M	Chromium	14.5		mg/kg	1
MW6-SS3	E-5	13-15	OUT	MONITORING WELL	M	Copper	21.6	*	mg/kg	2.5
MW6-SS3	E-5	13-15	OUT	MONITORING WELL	M	Lead	15.1	NSJ	mg/kg	0.3
MW6-SS3	E-5	13-15	OUT	MONITORING WELL	M	Mercury	0.057	U	mg/kg	0.1
MW6-SS3	E-5	13-15	OUT	MONITORING WELL	M	Nickel	20.5		mg/kg	4
MW6-SS3	E-5	13-15	OUT	MONITORING WELL	M	Selenium	0.90	NSJ	mg/kg	0.5
MW6-SS3	E-5	13-15	OUT	MONITORING WELL	M	Silver	0.65	U	mg/kg	1
MW6-SS3	E-5	13-15	OUT	MONITORING WELL	M	Thallium	0.078	UW	mg/kg	1
MW6-SS3	E-5	13-15	OUT	MONITORING WELL	M	Zinc	72.8		mg/kg	2

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – SOIL

SAMPLE #	GRID #	DEPTH	IN/OUT	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUAUFIER	UNITS	DETECTION UMIT
MW7-SS2	D-8	8-10	OUT	MONITORING WELL	V	1,1,1-Trichloroethane	88	J	ug/kg	5
MW7-SS2	D-8	8-10	OUT	MONITORING WELL	V	Benzene	2100		ug/kg	5
MW7-SS2	D-8	8-10	OUT	MONITORING WELL	V	Ethylbenzene	900		ug/kg	5
MW7-SS2	D-8	8-10	OUT	MONITORING WELL	V	m/p-Xylene	1000		ug/kg	5
MW7-SS2	D-8	8-10	OUT	MONITORING WELL	V	o-Xylene	1200		ug/kg	5
MW7-SS2	D-8	8-10	OUT	MONITORING WELL	SV	ALL SEMI-VOLATILES	ND	NA	ug/kg	NA
MW7-SS2	D-8	8-10	OUT	MONITORING WELL	M	Antimony	4.3	UNJ	mg/kg	6
MW7-SS2	D-8	8-10	OUT	MONITORING WELL	M	Arsenic	15.7	NJ	mg/kg	1
MW7-SS2	D-8	8-10	OUT	MONITORING WELL	M	Beryllium	0.65		mg/kg	0.5
MW7-SS2	D-8	8-10	OUT	MONITORING WELL	M	Cadmium	0.22	B	mg/kg	0.5
MW7-SS2	D-8	8-10	OUT	MONITORING WELL	M	Chromium	19		mg/kg	1
MW7-SS2	D-8	8-10	OUT	MONITORING WELL	M	Copper	28.4	*	mg/kg	2.5
MW7-SS2	D-8	8-10	OUT	MONITORING WELL	M	Lead	19.2	NSJ	mg/kg	0.3
MW7-SS2	D-8	8-10	OUT	MONITORING WELL	M	Mercury	0.059	U	mg/kg	0.1
MW7-SS2	D-8	8-10	OUT	MONITORING WELL	M	Nickel	25.7		mg/kg	4
MW7-SS2	D-8	8-10	OUT	MONITORING WELL	M	Selenium	0.19	UNJ	mg/kg	0.5
MW7-SS2	D-8	8-10	OUT	MONITORING WELL	M	Silver	0.71	U	mg/kg	1
MW7-SS2	D-8	8-10	OUT	MONITORING WELL	M	Thallium	0.27	BW	mg/kg	1
MW7-SS2	D-8	8-10	OUT	MONITORING WELL	M	Zinc	79.9		mg/kg	2
MW7-SS3	D-8	13-15	OUT	MONITORING WELL	V	Benzene	140		ug/kg	5
MW7-SS3	D-8	13-15	OUT	MONITORING WELL	V	Toluene	4	J	ug/kg	5
MW7-SS3	D-8	13-15	OUT	MONITORING WELL	SV	ALL SEMI-VOLATILES	ND	NA	ug/kg	NA
MW7-SS3	D-8	13-15	OUT	MONITORING WELL	M	Antimony	5	UNR	mg/kg	6
MW7-SS3	D-8	13-15	OUT	MONITORING WELL	M	Arsenic	15.8	NJ	mg/kg	1
MW7-SS3	D-8	13-15	OUT	MONITORING WELL	M	Beryllium	0.75		mg/kg	0.5
MW7-SS3	D-8	13-15	OUT	MONITORING WELL	M	Cadmium	0.24	U	mg/kg	0.5
MW7-SS3	D-8	13-15	OUT	MONITORING WELL	M	Chromium	22.4		mg/kg	1
MW7-SS3	D-8	13-15	OUT	MONITORING WELL	M	Copper	25.3	*	mg/kg	2.5
MW7-SS3	D-8	13-15	OUT	MONITORING WELL	M	Lead	25.2	NSJ	mg/kg	0.3
MW7-SS3	D-8	13-15	OUT	MONITORING WELL	M	Mercury	0.063	U	mg/kg	0.1
MW7-SS3	D-8	13-15	OUT	MONITORING WELL	M	Nickel	31.6		mg/kg	4
MW7-SS3	D-8	13-15	OUT	MONITORING WELL	M	Selenium	0.32	BNJ	mg/kg	0.5
MW7-SS3	D-8	13-15	OUT	MONITORING WELL	M	Silver	0.03	U	mg/kg	1
MW7-SS3	D-8	13-15	OUT	MONITORING WELL	M	Thallium	0.23	B	mg/kg	1
MW7-SS3	D-8	13-15	OUT	MONITORING WELL	M	Zinc	89.6		mg/kg	2

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – SOIL

SAMPLE #	GRID #	DEPTH	IN/OUT	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUALIFIER	UNITS	DETECTION LIMIT
MW8-SS2	C-10	8-10	OUT	MONITORING WELL	V	ALL VOLATILES	ND	NA	ug/kg	NA
MW8-SS2	C-10	8-10	OUT	MONITORING WELL	SV	ALL SEMI-VOLATILES	ND	NA	ug/kg	NA
MW8-SS2	C-10	8-10	OUT	MONITORING WELL	M	Antimony	4.5	UNR	mg/kg	6
MW8-SS2	C-10	8-10	OUT	MONITORING WELL	M	Arsenic	23	NJ	mg/kg	1
MW8-SS2	C-10	8-10	OUT	MONITORING WELL	M	Beryllium	0.58		mg/kg	0.5
MW8-SS2	C-10	8-10	OUT	MONITORING WELL	M	Cadmium	0.22	B	mg/kg	0.5
MW8-SS2	C-10	8-10	OUT	MONITORING WELL	M	Chromium	15.8		mg/kg	1
MW8-SS2	C-10	8-10	OUT	MONITORING WELL	M	Copper	25.7	*	mg/kg	2.5
MW8-SS2	C-10	8-10	OUT	MONITORING WELL	M	Lead	15.4	NSJ	mg/kg	0.3
MW8-SS2	C-10	8-10	OUT	MONITORING WELL	M	Mercury	0.057	U	mg/kg	0.1
MW8-SS2	C-10	8-10	OUT	MONITORING WELL	M	Nickel	32.1		mg/kg	4
MW8-SS2	C-10	8-10	OUT	MONITORING WELL	M	Selenium	1.7	NSJ	mg/kg	0.5
MW8-SS2	C-10	8-10	OUT	MONITORING WELL	M	Silver	0.73	U	mg/kg	1
MW8-SS2	C-10	8-10	OUT	MONITORING WELL	M	Thallium	0.098	UW	mg/kg	1
MW8-SS2	C-10	8-10	OUT	MONITORING WELL	M	Zinc	82.6		mg/kg	2
MW8-SS3	C-10	13-15	OUT	MONITORING WELL	V	Benzene	2	J	ug/kg	5
MW8-SS3	C-10	13-15	OUT	MONITORING WELL	SV	ALL SEMI-VOLATILES	ND	NA	ug/kg	NA
MW8-SS3	C-10	13-15	OUT	MONITORING WELL	M	Antimony	5	UNR	mg/kg	6
MW8-SS3	C-10	13-15	OUT	MONITORING WELL	M	Arsenic	5.2	BNJ	mg/kg	1
MW8-SS3	C-10	13-15	OUT	MONITORING WELL	M	Beryllium	0.29	U	mg/kg	0.5
MW8-SS3	C-10	13-15	OUT	MONITORING WELL	M	Cadmium	0.24	U	mg/kg	0.5
MW8-SS3	C-10	13-15	OUT	MONITORING WELL	M	Chromium	6.1		mg/kg	1
MW8-SS3	C-10	13-15	OUT	MONITORING WELL	M	Copper	12	*	mg/kg	2.5
MW8-SS3	C-10	13-15	OUT	MONITORING WELL	M	Lead	12.1	NSJ	mg/kg	0.3
MW8-SS3	C-10	13-15	OUT	MONITORING WELL	M	Mercury	0.063	U	mg/kg	0.1
MW8-SS3	C-10	13-15	OUT	MONITORING WELL	M	Nickel	13.1		mg/kg	4
MW8-SS3	C-10	13-15	OUT	MONITORING WELL	M	Selenium	0.8	NSJ	mg/kg	0.5
MW8-SS3	C-10	13-15	OUT	MONITORING WELL	M	Silver	0.83	U	mg/kg	1
MW8-SS3	C-10	13-15	OUT	MONITORING WELL	M	Thallium	0.083	U	mg/kg	1
MW8-SS3	C-10	13-15	OUT	MONITORING WELL	M	Zinc	59.5		mg/kg	2

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – SOIL

SAMPLE #	GRID #	DEPTH	IN/OUT	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUALIFIER	UNITS	DETECTION LIMIT
MW9-SS2	A-4	8-10	OUT	MONITORING WELL	V	ALL VOLATILES	ND	NA	ug/kg	NA
MW9-SS2	A-4	8-10	OUT	MONITORING WELL	SV	ALL SEMI-VOLATILES	ND	NA	ug/kg	NA
MW9-SS2	A-4	8-10	OUT	MONITORING WELL	M	Antimony	4.2	UNR	mg/kg	6
MW9-SS2	A-4	8-10	OUT	MONITORING WELL	M	Arsenic	16.2	NJ	mg/kg	1
MW9-SS2	A-4	8-10	OUT	MONITORING WELL	M	Beryllium	0.62		mg/kg	0.5
MW9-SS2	A-4	8-10	OUT	MONITORING WELL	M	Cadmium	0.31	B	mg/kg	0.5
MW9-SS2	A-4	8-10	OUT	MONITORING WELL	M	Chromium	13.1		mg/kg	1
MW9-SS2	A-4	8-10	OUT	MONITORING WELL	M	Copper	24.6		mg/kg	2.5
MW9-SS2	A-4	8-10	OUT	MONITORING WELL	M	Lead	13.0	NJ	mg/kg	0.3
MW9-SS2	A-4	8-10	OUT	MONITORING WELL	M	Mercury	0.050	U	mg/kg	0.1
MW9-SS2	A-4	8-10	OUT	MONITORING WELL	M	Nickel	31		mg/kg	4
MW9-SS2	A-4	8-10	OUT	MONITORING WELL	M	Selenium	0.40	BS	mg/kg	0.5
MW9-SS2	A-4	8-10	OUT	MONITORING WELL	M	Silver	0.60	U	mg/kg	1
MW9-SS2	A-4	8-10	OUT	MONITORING WELL	M	Thallium	0.4	B	mg/kg	1
MW9-SS2	A-4	8-10	OUT	MONITORING WELL	M	Zinc	84.7		mg/kg	2
MW9-SS3	A-4	13-15	OUT	MONITORING WELL	V	ALL VOLATILES	ND	NA	ug/kg	NA
MW9-SS3	A-4	13-15	OUT	MONITORING WELL	SV	ALL SEMI-VOLATILES	ND	NA	ug/kg	NA
MW9-SS3	A-4	13-15	OUT	MONITORING WELL	M	Antimony	4.2	UNR	mg/kg	6
MW9-SS3	A-4	13-15	OUT	MONITORING WELL	M	Arsenic	22.2	NJ	mg/kg	1
MW9-SS3	A-4	13-15	OUT	MONITORING WELL	M	Beryllium	0.72		mg/kg	0.5
MW9-SS3	A-4	13-15	OUT	MONITORING WELL	M	Cadmium	0.21	B	mg/kg	0.5
MW9-SS3	A-4	13-15	OUT	MONITORING WELL	M	Chromium	13.6		mg/kg	1
MW9-SS3	A-4	13-15	OUT	MONITORING WELL	M	Copper	24.9		mg/kg	2.5
MW9-SS3	A-4	13-15	OUT	MONITORING WELL	M	Lead	18.4	NJ	mg/kg	0.3
MW9-SS3	A-4	13-15	OUT	MONITORING WELL	M	Mercury	0.062	U	mg/kg	0.1
MW9-SS3	A-4	13-15	OUT	MONITORING WELL	M	Nickel	33		mg/kg	4
MW9-SS3	A-4	13-15	OUT	MONITORING WELL	M	Selenium	0.21	UW	mg/kg	0.5
MW9-SS3	A-4	13-15	OUT	MONITORING WELL	M	Silver	0.60	U	mg/kg	1
MW9-SS3	A-4	13-15	OUT	MONITORING WELL	M	Thallium	0.49	B	mg/kg	1
MW9-SS3	A-4	13-15	OUT	MONITORING WELL	M	Zinc	87.1		mg/kg	2

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – SOIL

SAMPLE #	GRID #	DEPTH	IN/OUT	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUALIFIER	UNITS	DETECTION LIMIT
MW10-SS1	A-8	3-5	OUT	MONITORING WELL	V	ALL VOLATILES	ND	NA	ug/kg	NA
MW10-SS1	A-8	3-5	OUT	MONITORING WELL	SV	ALL SEMI-VOLATILES	ND	NA	ug/kg	NA
MW10-SS1	A-8	3-5	OUT	MONITORING WELL	M	Antimony	1.6	J	mg/kg	6
MW10-SS1	A-8	3-5	OUT	MONITORING WELL	M	Arsenic	19.8	J	mg/kg	1
MW10-SS1	A-8	3-5	OUT	MONITORING WELL	M	Beryllium	1		mg/kg	0.5
MW10-SS1	A-8	3-5	OUT	MONITORING WELL	M	Cadmium	0.37		mg/kg	0.5
MW10-SS1	A-8	3-5	OUT	MONITORING WELL	M	Chromium	28.6	J	mg/kg	1
MW10-SS1	A-8	3-5	OUT	MONITORING WELL	M	Copper	49.3		mg/kg	2.5
MW10-SS1	A-8	3-5	OUT	MONITORING WELL	M	Lead	20.7		mg/kg	0.3
MW10-SS1	A-8	3-5	OUT	MONITORING WELL	M	Mercury	0.06	U	mg/kg	0.1
MW10-SS1	A-8	3-5	OUT	MONITORING WELL	M	Nickel	32.3		mg/kg	4
MW10-SS1	A-8	3-5	OUT	MONITORING WELL	M	Selenium	0.51	J	mg/kg	0.5
MW10-SS1	A-8	3-5	OUT	MONITORING WELL	M	Silver	0.44	U	mg/kg	1
MW10-SS1	A-8	3-5	OUT	MONITORING WELL	M	Thallium	0.51	J	mg/kg	1
MW10-SS1	A-8	3-5	OUT	MONITORING WELL	M	Zinc	109	J	mg/kg	2
MW10-SS3	A-8	13-15	OUT	MONITORING WELL	V	ALL VOLATILES	ND	NA	ug/kg	NA
MW10-SS3	A-8	13-15	OUT	MONITORING WELL	SV	ALL SEMI-VOLATILES	ND	NA	ug/kg	NA
MW10-SS3	A-8	13-15	OUT	MONITORING WELL	M	Antimony	2.2	J	mg/kg	6
MW10-SS3	A-8	13-15	OUT	MONITORING WELL	M	Arsenic	10.8	J	mg/kg	1
MW10-SS3	A-8	13-15	OUT	MONITORING WELL	M	Beryllium	0.25		mg/kg	0.5
MW10-SS3	A-8	13-15	OUT	MONITORING WELL	M	Cadmium	0.72		mg/kg	0.5
MW10-SS3	A-8	13-15	OUT	MONITORING WELL	M	Chromium	7.4	J	mg/kg	1
MW10-SS3	A-8	13-15	OUT	MONITORING WELL	M	Copper	22.6		mg/kg	2.5
MW10-SS3	A-8	13-15	OUT	MONITORING WELL	M	Lead	12.1	J	mg/kg	0.3
MW10-SS3	A-8	13-15	OUT	MONITORING WELL	M	Mercury	0.06	U	mg/kg	0.1
MW10-SS3	A-8	13-15	OUT	MONITORING WELL	M	Nickel	19.7		mg/kg	4
MW10-SS3	A-8	13-15	OUT	MONITORING WELL	M	Selenium	0.54	U	mg/kg	0.5
MW10-SS3	A-8	13-15	OUT	MONITORING WELL	M	Silver	0.75	U	mg/kg	1
MW10-SS3	A-8	13-15	OUT	MONITORING WELL	M	Thallium	0.54	J	mg/kg	1
MW10-SS3	A-8	13-15	OUT	MONITORING WELL	M	Zinc	88.3	J	mg/kg	2

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – SOIL

SAMPLE #	GRID #	DEPTH	IN/OUT	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUALIFIER	UNITS	DETECTION LIMIT
MW11-SS1	F-7	3-5	OUT	MONITORING WELL	V	ALL VOLATILES	ND	NA	ug/kg	NA
MW11-SS1	F-7	3-5	OUT	MONITORING WELL	SV	ALL SEMI-VOLATILES	ND	NA	ug/kg	NA
MW11-SS1	F-7	3-5	OUT	MONITORING WELL	M	Antimony	3.3	J	mg/kg	6
MW11-SS1	F-7	3-5	OUT	MONITORING WELL	M	Arsenic	17.9	J	mg/kg	1
MW11-SS1	F-7	3-5	OUT	MONITORING WELL	M	Beryllium	0.41		mg/kg	0.5
MW11-SS1	F-7	3-5	OUT	MONITORING WELL	M	Cadmium	0.83		mg/kg	0.5
MW11-SS1	F-7	3-5	OUT	MONITORING WELL	M	Chromium	9.5	J	mg/kg	1
MW11-SS1	F-7	3-5	OUT	MONITORING WELL	M	Copper	33.4		mg/kg	2.5
MW11-SS1	F-7	3-5	OUT	MONITORING WELL	M	Lead	16.2	J	mg/kg	0.3
MW11-SS1	F-7	3-5	OUT	MONITORING WELL	M	Mercury	0.06	U	mg/kg	0.1
MW11-SS1	F-7	3-5	OUT	MONITORING WELL	M	Nickel	20.2		mg/kg	4
MW11-SS1	F-7	3-5	OUT	MONITORING WELL	M	Selenium	0.38	U	mg/kg	0.5
MW11-SS1	F-7	3-5	OUT	MONITORING WELL	M	Silver	0.66	U	mg/kg	1
MW11-SS1	F-7	3-5	OUT	MONITORING WELL	M	Thallium	0.43	J	mg/kg	1
MW11-SS1	F-7	3-5	OUT	MONITORING WELL	M	Zinc	79.8	J	mg/kg	2
MW11-SS3	F-7	13-15	OUT	MONITORING WELL	V	ALL VOLATILES	ND	NA	ug/kg	NA
MW11-SS3	F-7	13-15	OUT	MONITORING WELL	SV	ALL SEMI-VOLATILES	ND	NA	ug/kg	NA
MW11-SS3	F-7	13-15	OUT	MONITORING WELL	M	Antimony	2.7	J	mg/kg	6
MW11-SS3	F-7	13-15	OUT	MONITORING WELL	M	Arsenic	13.4	J	mg/kg	1
MW11-SS3	F-7	13-15	OUT	MONITORING WELL	M	Beryllium	0.41		mg/kg	0.5
MW11-SS3	F-7	13-15	OUT	MONITORING WELL	M	Cadmium	0.59		mg/kg	0.5
MW11-SS3	F-7	13-15	OUT	MONITORING WELL	M	Chromium	11.1	J	mg/kg	1
MW11-SS3	F-7	13-15	OUT	MONITORING WELL	M	Copper	22		mg/kg	2.5
MW11-SS3	F-7	13-15	OUT	MONITORING WELL	M	Lead	15.2	J	mg/kg	0.3
MW11-SS3	F-7	13-15	OUT	MONITORING WELL	M	Mercury	0.06	U	mg/kg	0.1
MW11-SS3	F-7	13-15	OUT	MONITORING WELL	M	Nickel	16.8		mg/kg	4
MW11-SS3	F-7	13-15	OUT	MONITORING WELL	M	Selenium	0.5	J	mg/kg	0.5
MW11-SS3	F-7	13-15	OUT	MONITORING WELL	M	Silver	0.63	U	mg/kg	1
MW11-SS3	F-7	13-15	OUT	MONITORING WELL	M	Thallium	0.5	J	mg/kg	1
MW11-SS3	F-7	13-15	OUT	MONITORING WELL	M	Zinc	70.3	J	mg/kg	2

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – SOIL

SAMPLE #	GRID #	DEPTH	IN/OUT	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUALIFIER	UNITS	DETECTION LIMIT
MW12-SS1	E-9	3-5	OUT	MONITORING WELL	V	ALL VOLATILES	ND	NA	ug/kg	NA
MW12-SS1	E-9	3-5	OUT	MONITORING WELL	SV	ALL SEMI-VOLATILES	ND	NA	ug/kg	NA
MW12-SS1	E-9	3-5	OUT	MONITORING WELL	M	Antimony	1.4	J	mg/kg	6
MW12-SS1	E-9	3-5	OUT	MONITORING WELL	M	Arsenic	20.7	J	mg/kg	1
MW12-SS1	E-9	3-5	OUT	MONITORING WELL	M	Beryllium	0.64		mg/kg	0.5
MW12-SS1	E-9	3-5	OUT	MONITORING WELL	M	Cadmium	0.52		mg/kg	0.5
MW12-SS1	E-9	3-5	OUT	MONITORING WELL	M	Chromium	15.0	J	mg/kg	1
MW12-SS1	E-9	3-5	OUT	MONITORING WELL	M	Copper	36.7		mg/kg	2.5
MW12-SS1	E-9	3-5	OUT	MONITORING WELL	M	Lead	17.7		mg/kg	0.3
MW12-SS1	E-9	3-5	OUT	MONITORING WELL	M	Mercury	0.06	U	mg/kg	0.1
MW12-SS1	E-9	3-5	OUT	MONITORING WELL	M	Nickel	32.1		mg/kg	4
MW12-SS1	E-9	3-5	OUT	MONITORING WELL	M	Selenium	0.30	J	mg/kg	0.5
MW12-SS1	E-9	3-5	OUT	MONITORING WELL	M	Silver	0.40	U	mg/kg	1
MW12-SS1	E-9	3-5	OUT	MONITORING WELL	M	Thallium	0.30	J	mg/kg	1
MW12-SS1	E-9	3-5	OUT	MONITORING WELL	M	Zinc	90.2	J	mg/kg	2

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – SOIL

SAMPLE #	GRID #	DEPTH	IN/OUT	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUALIFIER	UNITS	DETECTION LIMIT
MW12-SS3	E-9	13-15	OUT	MONITORING WELL	V	ALL VOLATILES	ND	NA	ug/kg	NA
MW12-SS3	E-9	13-15	OUT	MONITORING WELL	SV	Phenanthrene	300	J	ug/kg	300
MW12-SS3	E-9	13-15	OUT	MONITORING WELL	SV	Anthracene	82	J	ug/kg	300
MW12-SS3	E-9	13-15	OUT	MONITORING WELL	SV	Carbazole	190	J	ug/kg	300
MW12-SS3	E-9	13-15	OUT	MONITORING WELL	SV	Fluoranthene	310	J	ug/kg	300
MW12-SS3	E-9	13-15	OUT	MONITORING WELL	SV	Pyrene	250	J	ug/kg	300
MW12-SS3	E-9	13-15	OUT	MONITORING WELL	SV	Benzo(a)Anthracene	110	J	ug/kg	300
MW12-SS3	E-9	13-15	OUT	MONITORING WELL	SV	Chrysene	130	J	ug/kg	300
MW12-SS3	E-9	13-15	OUT	MONITORING WELL	SV	Benzo(b)Fluoranthene	110	J	ug/kg	300
MW12-SS3	E-9	13-15	OUT	MONITORING WELL	SV	Benzo(a)Pyrene	87	J	ug/kg	300
MW12-SS3	E-9	13-15	OUT	MONITORING WELL	M	Antimony	2.9	J	mg/kg	6
MW12-SS3	E-9	13-15	OUT	MONITORING WELL	M	Arsenic	4	J	mg/kg	1
MW12-SS3	E-9	13-15	OUT	MONITORING WELL	M	Beryllium	0.22		mg/kg	0.5
MW12-SS3	E-9	13-15	OUT	MONITORING WELL	M	Cadmium	0.37		mg/kg	0.5
MW12-SS3	E-9	13-15	OUT	MONITORING WELL	M	Chromium	5.0	J	mg/kg	1
MW12-SS3	E-9	13-15	OUT	MONITORING WELL	M	Copper	30.5		mg/kg	2.5
MW12-SS3	E-9	13-15	OUT	MONITORING WELL	M	Lead	11	J	mg/kg	0.3
MW12-SS3	E-9	13-15	OUT	MONITORING WELL	M	Mercury	0.05	U	mg/kg	0.1
MW12-SS3	E-9	13-15	OUT	MONITORING WELL	M	Nickel	9.7		mg/kg	4
MW12-SS3	E-9	13-15	OUT	MONITORING WELL	M	Selenium	0.26	J	mg/kg	0.5
MW12-SS3	E-9	13-15	OUT	MONITORING WELL	M	Silver	0.47	U	mg/kg	1
MW12-SS3	E-9	13-15	OUT	MONITORING WELL	M	Thallium	0.26	J	mg/kg	1
MW12-SS3	E-9	13-15	OUT	MONITORING WELL	M	Zinc	50.1	J	mg/kg	2

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – SOIL

SAMPLE #	GRID #	DEPTH	IN/OUT	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUALIFIER	UNITS	DETECTION LIMIT
SS1	C-2	0-2	IN	SURFACE SOIL SAMPLE	V	NOT ANALIZED				
SS1	C-2	0-2	IN	SURFACE SOIL SAMPLE	SV	ALL SEMI-VOLATILES	ND	NA	ug/kg	NA
SS1	C-2	0-2	IN	SURFACE SOIL SAMPLE	M	Antimony	2.5	J	mg/kg	6
SS1	C-2	0-2	IN	SURFACE SOIL SAMPLE	M	Arsenic	12.6	J	mg/kg	1
SS1	C-2	0-2	IN	SURFACE SOIL SAMPLE	M	Beryllium	0.5		mg/kg	0.5
SS1	C-2	0-2	IN	SURFACE SOIL SAMPLE	M	Cadmium	0.63		mg/kg	0.5
SS1	C-2	0-2	IN	SURFACE SOIL SAMPLE	M	Chromium	12.4	J	mg/kg	1
SS1	C-2	0-2	IN	SURFACE SOIL SAMPLE	M	Copper	19.2		mg/kg	2.5
SS1	C-2	0-2	IN	SURFACE SOIL SAMPLE	M	Lead	23.1		mg/kg	0.3
SS1	C-2	0-2	IN	SURFACE SOIL SAMPLE	M	Mercury	0.06	U	mg/kg	0.1
SS1	C-2	0-2	IN	SURFACE SOIL SAMPLE	M	Nickel	10.6		mg/kg	4
SS1	C-2	0-2	IN	SURFACE SOIL SAMPLE	M	Selenium	0.30	J	mg/kg	0.5
SS1	C-2	0-2	IN	SURFACE SOIL SAMPLE	M	Silver	3	J	mg/kg	1
SS1	C-2	0-2	IN	SURFACE SOIL SAMPLE	M	Thallium	0.40	J	mg/kg	1
SS1	C-2	0-2	IN	SURFACE SOIL SAMPLE	M	Zinc	179	J	mg/kg	2
SS2	E-2	0-2	OUT	SURFACE SOIL SAMPLE	V	NOT ANALYZED				
SS2	E-2	0-2	OUT	SURFACE SOIL SAMPLE	SV	ALL SEMI-VOLATILES	ND	NA	ug/kg	NA
SS2	E-2	0-2	OUT	SURFACE SOIL SAMPLE	M	Antimony	1.7	J	mg/kg	6
SS2	E-2	0-2	OUT	SURFACE SOIL SAMPLE	M	Arsenic	10.8	J	mg/kg	1
SS2	E-2	0-2	OUT	SURFACE SOIL SAMPLE	M	Beryllium	0.41		mg/kg	0.5
SS2	E-2	0-2	OUT	SURFACE SOIL SAMPLE	M	Cadmium	0.6		mg/kg	0.5
SS2	E-2	0-2	OUT	SURFACE SOIL SAMPLE	M	Chromium	10.3	J	mg/kg	1
SS2	E-2	0-2	OUT	SURFACE SOIL SAMPLE	M	Copper	27.2		mg/kg	2.5
SS2	E-2	0-2	OUT	SURFACE SOIL SAMPLE	M	Lead	28.8		mg/kg	0.3
SS2	E-2	0-2	OUT	SURFACE SOIL SAMPLE	M	Mercury	0.05	U	mg/kg	0.1
SS2	E-2	0-2	OUT	SURFACE SOIL SAMPLE	M	Nickel	15.5		mg/kg	4
SS2	E-2	0-2	OUT	SURFACE SOIL SAMPLE	M	Selenium	0.5	J	mg/kg	0.5
SS2	E-2	0-2	OUT	SURFACE SOIL SAMPLE	M	Silver	0.50	U	mg/kg	1
SS2	E-2	0-2	OUT	SURFACE SOIL SAMPLE	M	Thallium	0.5	U	mg/kg	1
SS2	E-2	0-2	OUT	SURFACE SOIL SAMPLE	M	Zinc	109	J	mg/kg	2

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA

ANALYTICAL RESULTS – SOIL

SAMPLE #	GRID #	DEPTH	IN/OUT	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUALIFIER	UNITS	DETECTION LIMIT
SS3	E-1	0-2	OUT	SURFACE SOIL SAMPLE	V	NOT ANALYZED				
SS3	E-1	0-2	OUT	SURFACE SOIL SAMPLE	SV	Phenanthrene	110	J	ug/kg	300
SS3	E-1	0-2	OUT	SURFACE SOIL SAMPLE	SV	Fluoranthene	210	J	ug/kg	300
SS3	E-1	0-2	OUT	SURFACE SOIL SAMPLE	SV	Pyrene	170	J	ug/kg	300
SS3	E-1	0-2	OUT	SURFACE SOIL SAMPLE	SV	Benzo(a)Anthracene	84	J	ug/kg	300
SS3	E-1	0-2	OUT	SURFACE SOIL SAMPLE	SV	Chrysene	130	J	ug/kg	300
SS3	E-1	0-2	OUT	SURFACE SOIL SAMPLE	SV	Benzo(b)Fluoranthene	150	J	ug/kg	300
SS3	E-1	0-2	OUT	SURFACE SOIL SAMPLE	SV	Benzo(k)Fluoranthene	170	J	ug/kg	300
SS3	E-1	0-2	OUT	SURFACE SOIL SAMPLE	SV	Indeno(1,2,3-cd)Pyrene	84	J	ug/kg	300
SS3	E-1	0-2	OUT	SURFACE SOIL SAMPLE	M	Antimony	2	J	mg/kg	6
SS3	E-1	0-2	OUT	SURFACE SOIL SAMPLE	M	Arsenic	12.4	J	mg/kg	1
SS3	E-1	0-2	OUT	SURFACE SOIL SAMPLE	M	Beryllium	0.45		mg/kg	0.5
SS3	E-1	0-2	OUT	SURFACE SOIL SAMPLE	M	Cadmium	1		mg/kg	0.5
SS3	E-1	0-2	OUT	SURFACE SOIL SAMPLE	M	Chromium	12	J	mg/kg	1
SS3	E-1	0-2	OUT	SURFACE SOIL SAMPLE	M	Copper	49.2		mg/kg	2.5
SS3	E-1	0-2	OUT	SURFACE SOIL SAMPLE	M	Lead	30.6		mg/kg	0.3
SS3	E-1	0-2	OUT	SURFACE SOIL SAMPLE	M	Mercury	0.05	U	mg/kg	0.1
SS3	E-1	0-2	OUT	SURFACE SOIL SAMPLE	M	Nickel	14.9		mg/kg	4
SS3	E-1	0-2	OUT	SURFACE SOIL SAMPLE	M	Selenium	0.49	J	mg/kg	0.5
SS3	E-1	0-2	OUT	SURFACE SOIL SAMPLE	M	Silver	0.67	U	mg/kg	1
SS3	E-1	0-2	OUT	SURFACE SOIL SAMPLE	M	Thallium	0.49	U	mg/kg	1
SS3	E-1	0-2	OUT	SURFACE SOIL SAMPLE	M	Zinc	162	J	mg/kg	2
SS4	E-1	0-2	OUT	SURFACE SOIL SAMPLE	V	NOT ANALYZED				
SS4	E-1	0-2	OUT	SURFACE SOIL SAMPLE	SV	Pyrene	70	J	ug/kg	360
SS4	E-1	0-2	OUT	SURFACE SOIL SAMPLE	M	Antimony	3.3	J	mg/kg	6
SS4	E-1	0-2	OUT	SURFACE SOIL SAMPLE	M	Arsenic	7.5	J	mg/kg	1
SS4	E-1	0-2	OUT	SURFACE SOIL SAMPLE	M	Beryllium	0.2		mg/kg	0.5
SS4	E-1	0-2	OUT	SURFACE SOIL SAMPLE	M	Cadmium	2.2		mg/kg	0.5
SS4	E-1	0-2	OUT	SURFACE SOIL SAMPLE	M	Chromium	12	J	mg/kg	1
SS4	E-1	0-2	OUT	SURFACE SOIL SAMPLE	M	Copper	24		mg/kg	2.5
SS4	E-1	0-2	OUT	SURFACE SOIL SAMPLE	M	Lead	86.5		mg/kg	0.3
SS4	E-1	0-2	OUT	SURFACE SOIL SAMPLE	M	Mercury	0.05	U	mg/kg	0.1
SS4	E-1	0-2	OUT	SURFACE SOIL SAMPLE	M	Nickel	8.5		mg/kg	4
SS4	E-1	0-2	OUT	SURFACE SOIL SAMPLE	M	Selenium	0.4	J	mg/kg	0.5
SS4	E-1	0-2	OUT	SURFACE SOIL SAMPLE	M	Silver	0.57	U	mg/kg	1
SS4	E-1	0-2	OUT	SURFACE SOIL SAMPLE	M	Thallium	0.4	J	mg/kg	1
SS4	E-1	0-2	OUT	SURFACE SOIL SAMPLE	M	Zinc	129	J	mg/kg	2

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – SOIL

SAMPLE #	GRID #	DEPTH	IN/OUT	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUALIFIER	UNITS	DETECTION LIMIT
SS5	E-3	0-2	OUT	SURFACE SOIL SAMPLE	V	NOT ANALYZED				
SS5	E-3	0-2	OUT	SURFACE SOIL SAMPLE	SV	Fluoranthene	100	J	ug/kg	350
SS5	E-3	0-2	OUT	SURFACE SOIL SAMPLE	SV	Pyrene	80	J	ug/kg	350
SS5	E-3	0-2	OUT	SURFACE SOIL SAMPLE	SV	Chrysene	70	J	ug/kg	350
SS5	E-3	0-2	OUT	SURFACE SOIL SAMPLE	SV	Benzo(b)Fluoranthene	87	J	ug/kg	350
SS5	E-3	0-2	OUT	SURFACE SOIL SAMPLE	M	Antimony	2	J	mg/kg	6
SS5	E-3	0-2	OUT	SURFACE SOIL SAMPLE	M	Arsenic	19.5	J	mg/kg	1
SS5	E-3	0-2	OUT	SURFACE SOIL SAMPLE	M	Beryllium	0.69		mg/kg	0.5
SS5	E-3	0-2	OUT	SURFACE SOIL SAMPLE	M	Cadmium	0.74		mg/kg	0.5
SS5	E-3	0-2	OUT	SURFACE SOIL SAMPLE	M	Chromium	15.4	J	mg/kg	1
SS5	E-3	0-2	OUT	SURFACE SOIL SAMPLE	M	Copper	32.2		mg/kg	2.5
SS5	E-3	0-2	OUT	SURFACE SOIL SAMPLE	M	Lead	39.0		mg/kg	0.3
SS5	E-3	0-2	OUT	SURFACE SOIL SAMPLE	M	Mercury	0.06	U	mg/kg	0.1
SS5	E-3	0-2	OUT	SURFACE SOIL SAMPLE	M	Nickel	24.1		mg/kg	4
SS5	E-3	0-2	OUT	SURFACE SOIL SAMPLE	M	Selenium	0.43	J	mg/kg	0.5
SS5	E-3	0-2	OUT	SURFACE SOIL SAMPLE	M	Silver	0.55	U	mg/kg	1
SS5	E-3	0-2	OUT	SURFACE SOIL SAMPLE	M	Thallium	0.43	J	mg/kg	1
SS5	E-3	0-2	OUT	SURFACE SOIL SAMPLE	M	Zinc	199	J	mg/kg	2
SS6	E-4	0-2	OUT	SURFACE SOIL SAMPLE	V	NOT ANALYZED				
SS6	E-4	0-2	OUT	SURFACE SOIL SAMPLE	SV	Phenanthrene	76	J	ug/kg	350
SS6	E-4	0-2	OUT	SURFACE SOIL SAMPLE	SV	Anthracene	76	J	ug/kg	350
SS6	E-4	0-2	OUT	SURFACE SOIL SAMPLE	SV	Fluoranthene	100	J	ug/kg	350
SS6	E-4	0-2	OUT	SURFACE SOIL SAMPLE	SV	Pyrene	190	J	ug/kg	350
SS6	E-4	0-2	OUT	SURFACE SOIL SAMPLE	SV	Benzo(b)Fluoranthene	160	J	ug/kg	350
SS6	E-4	0-2	OUT	SURFACE SOIL SAMPLE	M	Antimony	1.0	J	mg/kg	6
SS6	E-4	0-2	OUT	SURFACE SOIL SAMPLE	M	Arsenic	16.2	J	mg/kg	1
SS6	E-4	0-2	OUT	SURFACE SOIL SAMPLE	M	Beryllium	0.40		mg/kg	0.5
SS6	E-4	0-2	OUT	SURFACE SOIL SAMPLE	M	Cadmium	0.9		mg/kg	0.5
SS6	E-4	0-2	OUT	SURFACE SOIL SAMPLE	M	Chromium	14.0	J	mg/kg	1
SS6	E-4	0-2	OUT	SURFACE SOIL SAMPLE	M	Copper	53.0		mg/kg	2.5
SS6	E-4	0-2	OUT	SURFACE SOIL SAMPLE	M	Lead	104		mg/kg	0.3
SS6	E-4	0-2	OUT	SURFACE SOIL SAMPLE	M	Mercury	0.05	U	mg/kg	0.1
SS6	E-4	0-2	OUT	SURFACE SOIL SAMPLE	M	Nickel	20.7		mg/kg	4
SS6	E-4	0-2	OUT	SURFACE SOIL SAMPLE	M	Selenium	0.41	J	mg/kg	0.5
SS6	E-4	0-2	OUT	SURFACE SOIL SAMPLE	M	Silver	0.6	U	mg/kg	1
SS6	E-4	0-2	OUT	SURFACE SOIL SAMPLE		Thallium	0.41	J	mg/kg	1
SS6	E-4	0-2	OUT	SURFACE SOIL SAMPLE		Zinc	522	J	mg/kg	2

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – SOIL

SAMPLE #	GRID #	DEPTH	IN/OUT	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUALIFIER	UNITS	DETECTION LIMIT
SS7	E–5	0–2	OUT	SURFACE SOIL SAMPLE	V	NOT ANALYZED				
SS7	E–5	0–2	OUT	SURFACE SOIL SAMPLE	SV	ALL SEMI–VOLATILES	ND	NA	ug/kg	NA
SS7	E–5	0–2	OUT	SURFACE SOIL SAMPLE	M	Antimony	1.9	J	mg/kg	6
SS7	E–5	0–2	OUT	SURFACE SOIL SAMPLE	M	Arsenic	10.9	J	mg/kg	1
SS7	E–5	0–2	OUT	SURFACE SOIL SAMPLE	M	Beryllium	0.39		mg/kg	0.5
SS7	E–5	0–2	OUT	SURFACE SOIL SAMPLE	M	Cadmium	0.51		mg/kg	0.5
SS7	E–5	0–2	OUT	SURFACE SOIL SAMPLE	M	Chromium	8.6	J	mg/kg	1
SS7	E–5	0–2	OUT	SURFACE SOIL SAMPLE	M	Copper	20.6		mg/kg	2.5
SS7	E–5	0–2	OUT	SURFACE SOIL SAMPLE	M	Lead	22.4		mg/kg	0.3
SS7	E–5	0–2	OUT	SURFACE SOIL SAMPLE	M	Mercury	0.05	U	mg/kg	0.1
SS7	E–5	0–2	OUT	SURFACE SOIL SAMPLE	M	Nickel	10.4		mg/kg	4
SS7	E–5	0–2	OUT	SURFACE SOIL SAMPLE	M	Selenium	0.43	J	mg/kg	0.5
SS7	E–5	0–2	OUT	SURFACE SOIL SAMPLE	M	Silver	0.63	U	mg/kg	1
SS7	E–5	0–2	OUT	SURFACE SOIL SAMPLE	M	Thallium	0.43	J	mg/kg	1
SS7	E–5	0–2	OUT	SURFACE SOIL SAMPLE	M	Zinc	81.3	J	mg/kg	2
SS8	E–3	0–2	OUT	SURFACE SOIL SAMPLE	V	NOT ANALYZED				
SS8	E–3	0–2	OUT	SURFACE SOIL SAMPLE	SV	Fluoranthene	93	J	ug/kg	350
SS8	E–3	0–2	OUT	SURFACE SOIL SAMPLE	SV	Pyrene	120	J	ug/kg	350
SS8	E–3	0–2	OUT	SURFACE SOIL SAMPLE	M	Antimony	2.1	J	mg/kg	6
SS8	E–3	0–2	OUT	SURFACE SOIL SAMPLE	M	Arsenic	13.3	J	mg/kg	1
SS8	E–3	0–2	OUT	SURFACE SOIL SAMPLE	M	Beryllium	0.53		mg/kg	0.5
SS8	E–3	0–2	OUT	SURFACE SOIL SAMPLE	M	Cadmium	1.5		mg/kg	0.5
SS8	E–3	0–2	OUT	SURFACE SOIL SAMPLE	M	Chromium	10.5	J	mg/kg	1
SS8	E–3	0–2	OUT	SURFACE SOIL SAMPLE	M	Copper	22.5		mg/kg	2.5
SS8	E–3	0–2	OUT	SURFACE SOIL SAMPLE	M	Lead	61.0		mg/kg	0.3
SS8	E–3	0–2	OUT	SURFACE SOIL SAMPLE	M	Mercury	0.06	U	mg/kg	0.1
SS8	E–3	0–2	OUT	SURFACE SOIL SAMPLE	M	Nickel	42.9		mg/kg	4
SS8	E–3	0–2	OUT	SURFACE SOIL SAMPLE	M	Selenium	0.42	J	mg/kg	0.5
SS8	E–3	0–2	OUT	SURFACE SOIL SAMPLE	M	Silver	0.7	U	mg/kg	1
SS8	E–3	0–2	OUT	SURFACE SOIL SAMPLE	M	Thallium	0.42	J	mg/kg	1
SS8	E–3	0–2	OUT	SURFACE SOIL SAMPLE	M	Zinc	394	J	mg/kg	2

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – SOIL

SAMPLE #	GRID #	DEPTH	IN/OUT	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUALIFIER	UNITS	DETECTION LIMIT
SS9	F-3	0-2	OUT	SURFACE SOIL SAMPLE	V	NOT ANALYZED				
SS9	F-3	0-2	OUT	SURFACE SOIL SAMPLE	SV	Phenanthrene	310	J	ug/kg	350
SS9	F-3	0-2	OUT	SURFACE SOIL SAMPLE	SV	Fluoranthene	300	J	ug/kg	350
SS9	F-3	0-2	OUT	SURFACE SOIL SAMPLE	SV	Pyrene	430	J	ug/kg	350
SS9	F-3	0-2	OUT	SURFACE SOIL SAMPLE	SV	Benzo(a)Anthracene	200	J	ug/kg	350
SS9	F-3	0-2	OUT	SURFACE SOIL SAMPLE	SV	Chrysene	330	J	ug/kg	350
SS9	F-3	0-2	OUT	SURFACE SOIL SAMPLE	SV	Benzo(b)Fluoranthene	520	J	ug/kg	350
SS9	F-3	0-2	OUT	SURFACE SOIL SAMPLE	M	Antimony	1.8	J	mg/kg	6
SS9	F-3	0-2	OUT	SURFACE SOIL SAMPLE	M	Arsenic	15.8	J	mg/kg	1
SS9	F-3	0-2	OUT	SURFACE SOIL SAMPLE	M	Beryllium	0.68		mg/kg	0.5
SS9	F-3	0-2	OUT	SURFACE SOIL SAMPLE	M	Cadmium	1.7		mg/kg	0.5
SS9	F-3	0-2	OUT	SURFACE SOIL SAMPLE	M	Chromium	14.9	J	mg/kg	1
SS9	F-3	0-2	OUT	SURFACE SOIL SAMPLE	M	Copper	32.3		mg/kg	2.5
SS9	F-3	0-2	OUT	SURFACE SOIL SAMPLE	M	Lead	99.7		mg/kg	0.3
SS9	F-3	0-2	OUT	SURFACE SOIL SAMPLE	M	Mercury	0.05	U	mg/kg	0.1
SS9	F-3	0-2	OUT	SURFACE SOIL SAMPLE	M	Nickel	27.8		mg/kg	4
SS9	F-3	0-2	OUT	SURFACE SOIL SAMPLE	M	Selenium	0.43	J	mg/kg	0.5
SS9	F-3	0-2	OUT	SURFACE SOIL SAMPLE	M	Silver	0.8	U	mg/kg	1
SS9	F-3	0-2	OUT	SURFACE SOIL SAMPLE	M	Thallium	0.43	J	mg/kg	1
SS9	F-3	0-2	OUT	SURFACE SOIL SAMPLE	M	Zinc	441	J	mg/kg	2

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – SOIL

SAMPLE #	GRID #	DEPTH	IN/OUT	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUAUFIER	UNITS	DETECTION LIMIT
SS10	E-4	0-2	OUT	SURFACE SOIL SAMPLE	V	NOT ANALYZED				
SS10	E-4	0-2	OUT	SURFACE SOIL SAMPLE	SV	Phenanthrene	120	J	ug/kg	300
SS10	E-4	0-2	OUT	SURFACE SOIL SAMPLE	SV	Fluoranthene	220	J	ug/kg	300
SS10	E-4	0-2	OUT	SURFACE SOIL SAMPLE	SV	Pyrene	100	J	ug/kg	300
SS10	E-4	0-2	OUT	SURFACE SOIL SAMPLE	SV	Benzo(a)Anthracene	86	J	ug/kg	300
SS10	E-4	0-2	OUT	SURFACE SOIL SAMPLE	SV	Chrysene	140	J	ug/kg	300
SS10	E-4	0-2	OUT	SURFACE SOIL SAMPLE	SV	Benzo(b)Fluoranthene	150	J	ug/kg	300
SS10	E-4	0-2	OUT	SURFACE SOIL SAMPLE	SV	Indeno(1,2,3-cd)Pyrene	81	J	ug/kg	300
SS10	E-4	0-2	OUT	SURFACE SOIL SAMPLE	M	Antimony	1.9	J	mg/kg	6
SS10	E-4	0-2	OUT	SURFACE SOIL SAMPLE	M	Arsenic	17.4	J	mg/kg	1
SS10	E-4	0-2	OUT	SURFACE SOIL SAMPLE	M	Beryllium	0.71		mg/kg	0.5
SS10	E-4	0-2	OUT	SURFACE SOIL SAMPLE	M	Cadmium	1.1		mg/kg	0.5
SS10	E-4	0-2	OUT	SURFACE SOIL SAMPLE	M	Chromium	18.5	J	mg/kg	1
SS10	E-4	0-2	OUT	SURFACE SOIL SAMPLE	M	Copper	34.1		mg/kg	2.5
SS10	E-4	0-2	OUT	SURFACE SOIL SAMPLE	M	Lead	50.2		mg/kg	0.3
SS10	E-4	0-2	OUT	SURFACE SOIL SAMPLE	M	Mercury	0.05	U	mg/kg	0.1
SS10	E-4	0-2	OUT	SURFACE SOIL SAMPLE	M	Nickel	31.0		mg/kg	4
SS10	E-4	0-2	OUT	SURFACE SOIL SAMPLE	M	Selenium	0.47	J	mg/kg	0.5
SS10	E-4	0-2	OUT	SURFACE SOIL SAMPLE	M	Silver	0.64	U	mg/kg	1
SS10	E-4	0-2	OUT	SURFACE SOIL SAMPLE	M	Thallium	0.47	J	mg/kg	1
SS10	E-4	0-2	OUT	SURFACE SOIL SAMPLE	M	Zinc	274	J	mg/kg	2
HB1-SS1	C-3	0-2	IN	HAND BORING	V	Methylene Chloride	92000	A	ug/kg	5
HB1-SS1	C-3	0-2	IN	HAND BORING	V	o-Xylene	440000	I	ug/kg	5
HB1-SS1	C-3	0-2	IN	HAND BORING	SV	2-Methylnaphthalene	1100		ug/kg	330
HB1-SS1	C-3	0-2	IN	HAND BORING	M	Antimony	ND	N	mg/kg	6
HB1-SS1	C-3	0-2	IN	HAND BORING	M	Arsenic	15		mg/kg	0.5
HB1-SS1	C-3	0-2	IN	HAND BORING	M	Beryllium	0.78		mg/kg	0.1
HB1-SS1	C-3	0-2	IN	HAND BORING	M	Cadmium	4	G	mg/kg	1
HB1-SS1	C-3	0-2	IN	HAND BORING	M	Chromium	16.3		mg/kg	1
HB1-SS1	C-3	0-2	IN	HAND BORING	M	Copper	19.7		mg/kg	1
HB1-SS1	C-3	0-2	IN	HAND BORING	M	Lead	15.7		mg/kg	5
HB1-SS1	C-3	0-2	IN	HAND BORING	M	Mercury	ND		mg/kg	0.1
HB1-SS1	C-3	0-2	IN	HAND BORING	M	Nickel	21.7		mg/kg	1
HB1-SS1	C-3	0-2	IN	HAND BORING	M	Selenium	ND	W	mg/kg	0.5
HB1-SS1	C-3	0-2	IN	HAND BORING	M	Silver	ND		mg/kg	1
HB1-SS1	C-3	0-2	IN	HAND BORING	M	Thallium	ND		mg/kg	10
HB1-SS1	C-3	0-2	IN	HAND BORING	M	Zinc	72.5		mg/kg	1

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – SOIL

SAMPLE #	GRID #	DEPTH	IN/OUT	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUALIFIER	UNITS	DETECTION LIMIT
HB1-SS2	C-3	0-2	IN	HAND BORING	V	Methylene Chloride	30000	A	ug/kg	5
HB1-SS2	C-3	0-2	IN	HAND BORING	V	o-Xylene	300000	I	ug/kg	5
HB1-SS2	C-3	0-2	IN	HAND BORING	SV	Naphthalene	390		ug/kg	330
HB1-SS2	C-3	0-2	IN	HAND BORING	SV	2-Methylnaphthalene	960		ug/kg	330
HB1-SS2	C-3	0-2	IN	HAND BORING	M	Antimony	ND	N	mg/kg	6
HB1-SS2	C-3	0-2	IN	HAND BORING	M	Arsenic	11.5	N	mg/kg	0.5
HB1-SS2	C-3	0-2	IN	HAND BORING	M	Beryllium	ND	N	mg/kg	0.1
HB1-SS2	C-3	0-2	IN	HAND BORING	M	Cadmium	ND	N	mg/kg	1
HB1-SS2	C-3	0-2	IN	HAND BORING	M	Chromium	16.2	N	mg/kg	1
HB1-SS2	C-3	0-2	IN	HAND BORING	M	Copper	21.9	N	mg/kg	1
HB1-SS2	C-3	0-2	IN	HAND BORING	M	Lead	10		mg/kg	5
HB1-SS2	C-3	0-2	IN	HAND BORING	M	Mercury	ND		mg/kg	0.1
HB1-SS2	C-3	0-2	IN	HAND BORING	M	Nickel	27.6	N	mg/kg	1
HB1-SS2	C-3	0-2	IN	HAND BORING	M	Selenium	ND		mg/kg	0.5
HB1-SS2	C-3	0-2	IN	HAND BORING	M	Silver	ND		mg/kg	1
HB1-SS2	C-3	0-2	IN	HAND BORING	M	Thallium	ND		mg/kg	10
HB1-SS2	C-3	0-2	IN	HAND BORING	M	Zinc	82.1	N	mg/kg	1
HB1-SS3	C-3	3-5	IN	HAND BORING	V	Ethylbenzene	120000	g	ug/kg	5
HB1-SS3	C-3	3-5	IN	HAND BORING	V	Methylene Chloride	130000	A	ug/kg	5
HB1-SS3	C-3	3-5	IN	HAND BORING	V	o-Xylene	1900000	g	ug/kg	5
HB1-SS3	C-3	3-5	IN	HAND BORING	SV	Di-n-butyl Phthalate	600		ug/kg	330
HB1-SS3	C-3	3-5	IN	HAND BORING	SV	Naphthalene	1600		ug/kg	330
HB1-SS3	C-3	3-5	IN	HAND BORING	SV	2-Methylnaphthalene	2000		ug/kg	330
HB1-SS3	C-3	3-5	IN	HAND BORING	M	Antimony	ND	N	mg/kg	6
HB1-SS3	C-3	3-5	IN	HAND BORING	M	Arsenic	17.6		mg/kg	0.5
HB1-SS3	C-3	3-5	IN	HAND BORING	M	Beryllium	0.84		mg/kg	0.1
HB1-SS3	C-3	3-5	IN	HAND BORING	M	Cadmium	6.9	G	mg/kg	1
HB1-SS3	C-3	3-5	IN	HAND BORING	M	Chromium	18.4		mg/kg	1
HB1-SS3	C-3	3-5	IN	HAND BORING	M	Copper	22.7		mg/kg	1
HB1-SS3	C-3	3-5	IN	HAND BORING	M	Lead	10		mg/kg	5
HB1-SS3	C-3	3-5	IN	HAND BORING	M	Mercury	ND		mg/kg	0.1
HB1-SS3	C-3	3-5	IN	HAND BORING	M	Nickel	25.3		mg/kg	1
HB1-SS3	C-3	3-5	IN	HAND BORING	M	Selenium	ND		mg/kg	0.5
HB1-SS3	C-3	3-5	IN	HAND BORING	M	Silver	ND		mg/kg	1
HB1-SS3	C-3	3-5	IN	HAND BORING	M	Thallium	ND		mg/kg	10
HB1-SS3	C-3	3-5	IN	HAND BORING	M	Zinc	83.3		mg/kg	1

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – SOIL

SAMPLE #	GRID #	DEPTH	IN/OUT	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUALIFIER	UNITS	DETECTION LIMIT
HB2+3-SS1	C-6	0-2	IN	HAND BORING	V	ALL VOLATILES	ND	NA	ug/kg	NA
HB2+3-SS1	C-6	0-2	IN	HAND BORING	SV	Naphthalene	870		ug/kg	330
HB2+3-SS1	C-6	0-2	IN	HAND BORING	SV	2-Methylnaphthalene	1900		ug/kg	330
HB2+3-SS1	C-6	0-2	IN	HAND BORING	M	Antimony	ND	N	mg/kg	6
HB2+3-SS1	C-6	0-2	IN	HAND BORING	M	Arsenic	12	N	mg/kg	0.5
HB2+3-SS1	C-6	0-2	IN	HAND BORING	M	Beryllium	ND	N	mg/kg	0.1
HB2+3-SS1	C-6	0-2	IN	HAND BORING	M	Cadmium	ND	N	mg/kg	1
HB2+3-SS1	C-6	0-2	IN	HAND BORING	M	Chromium	14.1	N	mg/kg	1
HB2+3-SS1	C-6	0-2	IN	HAND BORING	M	Copper	19.5	N	mg/kg	1
HB2+3-SS1	C-6	0-2	IN	HAND BORING	M	Lead	27		mg/kg	5
HB2+3-SS1	C-6	0-2	IN	HAND BORING	M	Mercury	ND		mg/kg	0.1
HB2+3-SS1	C-6	0-2	IN	HAND BORING	M	Nickel	21.4	N	mg/kg	1
HB2+3-SS1	C-6	0-2	IN	HAND BORING	M	Selenium	ND	W	mg/kg	0.5
HB2+3-SS1	C-6	0-2	IN	HAND BORING	M	Silver	ND		mg/kg	1
HB2+3-SS1	C-6	0-2	IN	HAND BORING	M	Thallium	ND		mg/kg	10
HB2+3-SS1	C-6	0-2	IN	HAND BORING	M	Zinc	86.1	N	mg/kg	1
HB2-SS2	C-6	0-2	IN	HAND BORING	V	o-Xylene	43	e	ug/kg	5
HB2-SS2	C-6	0-2	IN	HAND BORING	SV	Di-n-butyl Phthalate	3900		ug/kg	330
HB2-SS2	C-6	0-2	IN	HAND BORING	SV	Naphthalene	5400		ug/kg	330
HB2-SS2	C-6	0-2	IN	HAND BORING	SV	Phenanthrene	5600		ug/kg	330
HB2-SS2	C-6	0-2	IN	HAND BORING	SV	2-Methylnaphthalene	23000		ug/kg	330
HB2-SS2	C-6	0-2	IN	HAND BORING	M	Antimony	ND	N	mg/kg	6
HB2-SS2	C-6	0-2	IN	HAND BORING	M	Arsenic	10.5		mg/kg	0.5
HB2-SS2	C-6	0-2	IN	HAND BORING	M	Beryllium	0.81		mg/kg	0.1
HB2-SS2	C-6	0-2	IN	HAND BORING	M	Cadmium	8.2	G	mg/kg	1
HB2-SS2	C-6	0-2	IN	HAND BORING	M	Chromium	17.7		mg/kg	1
HB2-SS2	C-6	0-2	IN	HAND BORING	M	Copper	24.4		mg/kg	1
HB2-SS2	C-6	0-2	IN	HAND BORING	M	Lead	9.8	N	mg/kg	5
HB2-SS2	C-6	0-2	IN	HAND BORING	M	Mercury	ND		mg/kg	0.1
HB2-SS2	C-6	0-2	IN	HAND BORING	M	Nickel	28.8		mg/kg	1
HB2-SS2	C-6	0-2	IN	HAND BORING	M	Selenium	ND	W	mg/kg	0.5
HB2-SS2	C-6	0-2	IN	HAND BORING	M	Silver	ND		mg/kg	1
HB2-SS2	C-6	0-2	IN	HAND BORING	M	Thallium	ND		mg/kg	10
HB2-SS2	C-6	0-2	IN	HAND BORING	M	Zinc	85.5		mg/kg	1

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – SOIL

SAMPLE #	GRID #	DEPTH	IN/OUT	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUALIFIER	UNITS	DETECTION LIMIT
HB2-SS3	C-6	3-5	IN	HAND BORING	V	ALL VOLATILES	ND	NA	ug/kg	NA
HB2-SS3	C-6	3-5	IN	HAND BORING	SV	Di-n-butyl Phthalate	2900		ug/kg	330
HB2-SS3	C-6	3-5	IN	HAND BORING	SV	Fluorene	400		ug/kg	330
HB2-SS3	C-6	3-5	IN	HAND BORING	SV	Naphthalene	570		ug/kg	330
HB2-SS3	C-6	3-5	IN	HAND BORING	SV	Phenanthrene	700		ug/kg	330
HB2-SS3	C-6	3-5	IN	HAND BORING	SV	2-Methylnaphthalene	2000		ug/kg	330
HB2-SS3	C-6	3-5	IN	HAND BORING	M	Antimony	ND	N	mg/kg	6
HB2-SS3	C-6	3-5	IN	HAND BORING	M	Arsenic	11.4	N	mg/kg	0.5
HB2-SS3	C-6	3-5	IN	HAND BORING	M	Beryllium	ND	N	mg/kg	0.1
HB2-SS3	C-6	3-5	IN	HAND BORING	M	Cadmium	ND	N	mg/kg	1
HB2-SS3	C-6	3-5	IN	HAND BORING	M	Chromium	10.1	N	mg/kg	1
HB2-SS3	C-6	3-5	IN	HAND BORING	M	Copper	10.2	N	mg/kg	1
HB2-SS3	C-6	3-5	IN	HAND BORING	M	Lead	8.2	B	mg/kg	5
HB2-SS3	C-6	3-5	IN	HAND BORING	M	Mercury	ND		mg/kg	0.1
HB2-SS3	C-6	3-5	IN	HAND BORING	M	Nickel	25	N	mg/kg	1
HB2-SS3	C-6	3-5	IN	HAND BORING	M	Selenium	ND		mg/kg	0.5
HB2-SS3	C-6	3-5	IN	HAND BORING	M	Silver	ND		mg/kg	1
HB2-SS3	C-6	3-5	IN	HAND BORING	M	Thallium	ND		mg/kg	10
HB2-SS3	C-6	3-5	IN	HAND BORING	M	Zinc	73.4	N	mg/kg	1
HB4-SS1	B-3	0-2	IN	HAND BORING	V	ALL VOLATILES	ND	NA	ug/kg	NA
HB4-SS1	B-3	0-2	IN	HAND BORING	SV	Pyrene	530		ug/kg	330
HB4-SS1	B-3	0-2	IN	HAND BORING	M	Antimony	ND	N	mg/kg	6
HB4-SS1	B-3	0-2	IN	HAND BORING	M	Arsenic	7.9	N	mg/kg	0.5
HB4-SS1	B-3	0-2	IN	HAND BORING	M	Beryllium	0.4	B	mg/kg	0.1
HB4-SS1	B-3	0-2	IN	HAND BORING	M	Cadmium	ND		mg/kg	1
HB4-SS1	B-3	0-2	IN	HAND BORING	M	Chromium	10	G	mg/kg	1
HB4-SS1	B-3	0-2	IN	HAND BORING	M	Copper	26	*	mg/kg	1
HB4-SS1	B-3	0-2	IN	HAND BORING	M	Lead	27	*	mg/kg	5
HB4-SS1	B-3	0-2	IN	HAND BORING	M	Mercury	ND	u	mg/kg	0.1
HB4-SS1	B-3	0-2	IN	HAND BORING	M	Nickel	23	*	mg/kg	1
HB4-SS1	B-3	0-2	IN	HAND BORING	M	Selenium	ND	N	mg/kg	0.5
HB4-SS1	B-3	0-2	IN	HAND BORING	M	Silver	ND		mg/kg	1
HB4-SS1	B-3	0-2	IN	HAND BORING	M	Thallium	ND	N	mg/kg	10
HB4-SS1	B-3	0-2	IN	HAND BORING	M	Zinc	109		mg/kg	1

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – SOIL

SAMPLE #	GRID #	DEPTH	IN/OUT	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUALIFIER	UNITS	DETECTION LIMIT
HB4–SS2	B–3	0–2	IN	HAND BORING	V	ALL VOLATILES	ND	NA	ug/kg	NA
HB4–SS2	B–3	0–2	IN	HAND BORING	SV	ALL SEMI–VOLATILES	ND	NA	ug/kg	NA
HB4–SS2	B–3	0–2	IN	HAND BORING	M	Antimony	ND	N	mg/kg	6
HB4–SS2	B–3	0–2	IN	HAND BORING	M	Arsenic	42	N	mg/kg	0.5
HB4–SS2	B–3	0–2	IN	HAND BORING	M	Beryllium	0.9	*	mg/kg	0.1
HB4–SS2	B–3	0–2	IN	HAND BORING	M	Cadmium	ND		mg/kg	1
HB4–SS2	B–3	0–2	IN	HAND BORING	M	Chromium	15	G	mg/kg	1
HB4–SS2	B–3	0–2	IN	HAND BORING	M	Copper	30		mg/kg	1
HB4–SS2	B–3	0–2	IN	HAND BORING	M	Lead	20	*	mg/kg	5
HB4–SS2	B–3	0–2	IN	HAND BORING	M	Mercury	ND	u	mg/kg	0.1
HB4–SS2	B–3	0–2	IN	HAND BORING	M	Nickel	60	*	mg/kg	1
HB4–SS2	B–3	0–2	IN	HAND BORING	M	Selenium	ND	N	mg/kg	0.5
HB4–SS2	B–3	0–2	IN	HAND BORING	M	Silver	ND		mg/kg	1
HB4–SS2	B–3	0–2	IN	HAND BORING	M	Thallium	ND	N	mg/kg	10
HB4–SS2	B–3	0–2	IN	HAND BORING	M	Zinc	131		mg/kg	1
HB4–SS3	B–3	3–5	IN	HAND BORING	V	ALL VOLATILES	ND	NA	ug/kg	NA
HB4–SS3	B–3	3–5	IN	HAND BORING	SV	ALL SEMI–VOLATILES	ND	NA	ug/kg	NA
HB4–SS3	B–3	3–5	IN	HAND BORING	M	Antimony	ND	N	mg/kg	6
HB4–SS3	B–3	3–5	IN	HAND BORING	M	Arsenic	29	N	mg/kg	0.5
HB4–SS3	B–3	3–5	IN	HAND BORING	M	Beryllium	0.6	*	mg/kg	0.1
HB4–SS3	B–3	3–5	IN	HAND BORING	M	Cadmium	ND		mg/kg	1
HB4–SS3	B–3	3–5	IN	HAND BORING	M	Chromium	12	G	mg/kg	1
HB4–SS3	B–3	3–5	IN	HAND BORING	M	Copper	35	*	mg/kg	1
HB4–SS3	B–3	3–5	IN	HAND BORING	M	Lead	10	*	mg/kg	5
HB4–SS3	B–3	3–5	IN	HAND BORING	M	Mercury	ND	u	mg/kg	0.1
HB4–SS3	B–3	3–5	IN	HAND BORING	M	Nickel	41	*	mg/kg	1
HB4–SS3	B–3	3–5	IN	HAND BORING	M	Selenium	ND	N	mg/kg	0.5
HB4–SS3	B–3	3–5	IN	HAND BORING	M	Silver	ND		mg/kg	1
HB4–SS3	B–3	3–5	IN	HAND BORING	M	Thallium	ND	N	mg/kg	10
HB4–SS3	B–3	3–5	IN	HAND BORING	M	Zinc	108		mg/kg	1

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – SOIL

SAMPLE #	GRID #	DEPTH	IN/OUT	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUALIFIER	UNITS	DETECTION LIMIT
HB5-SS1	C-4	0-2	IN	HAND BORING	V	ALL VOLATILES	ND	NA	ug/kg	NA
HB5-SS1	C-4	0-2	IN	HAND BORING	SV	ALL SEMI-VOLATILES	ND	NA	ug/kg	NA
HB5-SS1	C-4	0-2	IN	HAND BORING	M	Antimony	ND	N	mg/kg	6
HB5-SS1	C-4	0-2	IN	HAND BORING	M	Arsenic	8.4		mg/kg	0.5
HB5-SS1	C-4	0-2	IN	HAND BORING	M	Beryllium	0.5		mg/kg	0.1
HB5-SS1	C-4	0-2	IN	HAND BORING	M	Cadmium	ND		mg/kg	1
HB5-SS1	C-4	0-2	IN	HAND BORING	M	Chromium	10		mg/kg	1
HB5-SS1	C-4	0-2	IN	HAND BORING	M	Copper	23		mg/kg	1
HB5-SS1	C-4	0-2	IN	HAND BORING	M	Lead	19	*	mg/kg	5
HB5-SS1	C-4	0-2	IN	HAND BORING	M	Mercury	ND	u	mg/kg	0.1
HB5-SS1	C-4	0-2	IN	HAND BORING	M	Nickel	25		mg/kg	1
HB5-SS1	C-4	0-2	IN	HAND BORING	M	Selenium	ND	N	mg/kg	0.5
HB5-SS1	C-4	0-2	IN	HAND BORING	M	Silver	ND		mg/kg	1
HB5-SS1	C-4	0-2	IN	HAND BORING	M	Thallium	ND		mg/kg	10
HB5-SS1	C-4	0-2	IN	HAND BORING	M	Zinc	83	N	mg/kg	1
HB6-SS1	D-5	0-2	IN	HAND BORING	V	ALL VOLATILES	ND	NA	ug/kg	NA
HB6-SS1	D-5	0-2	IN	HAND BORING	SV	ALL SEMI-VOLATILES	ND	NA	ug/kg	NA
HB6-SS1	D-5	0-2	IN	HAND BORING	M	Antimony	ND	N	mg/kg	6
HB6-SS1	D-5	0-2	IN	HAND BORING	M	Arsenic	4.1		mg/kg	0.5
HB6-SS1	D-5	0-2	IN	HAND BORING	M	Beryllium	0.5		mg/kg	0.1
HB6-SS1	D-5	0-2	IN	HAND BORING	M	Cadmium	ND		mg/kg	1
HB6-SS1	D-5	0-2	IN	HAND BORING	M	Chromium	10		mg/kg	1
HB6-SS1	D-5	0-2	IN	HAND BORING	M	Copper	22		mg/kg	1
HB6-SS1	D-5	0-2	IN	HAND BORING	M	Lead	11	*	mg/kg	5
HB6-SS1	D-5	0-2	IN	HAND BORING	M	Mercury	ND	u	mg/kg	0.1
HB6-SS1	D-5	0-2	IN	HAND BORING	M	Nickel	18		mg/kg	1
HB6-SS1	D-5	0-2	IN	HAND BORING	M	Selenium	ND	N	mg/kg	0.5
HB6-SS1	D-5	0-2	IN	HAND BORING	M	Silver	ND		mg/kg	1
HB6-SS1	D-5	0-2	IN	HAND BORING	M	Thallium	ND		mg/kg	10
HB6-SS1	D-5	0-2	IN	HAND BORING	M	Zinc	79	N	mg/kg	1

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – SOIL

SAMPLE #	GRID #	DEPTH	IN/OUT	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUALIFIER	UNITS	DETECTION LIMIT
HB6-SS2	D-5	0-2	IN	HAND BORING	V	ALL VOLATILES	ND	NA	ug/kg	NA
HB6-SS2	D-5	0-2	IN	HAND BORING	SV	ALL SEMI-VOLATILES	ND	NA	ug/kg	NA
HB6-SS2	D-5	0-2	IN	HAND BORING	M	Antimony	ND	N	mg/kg	6
HB6-SS2	D-5	0-2	IN	HAND BORING	M	Arsenic	15		mg/kg	0.5
HB6-SS2	D-5	0-2	IN	HAND BORING	M	Beryllium	0.5		mg/kg	0.1
HB6-SS2	D-5	0-2	IN	HAND BORING	M	Cadmium	ND		mg/kg	1
HB6-SS2	D-5	0-2	IN	HAND BORING	M	Chromium	12		mg/kg	1
HB6-SS2	D-5	0-2	IN	HAND BORING	M	Copper	32		mg/kg	1
HB6-SS2	D-5	0-2	IN	HAND BORING	M	Lead	10	*	mg/kg	5
HB6-SS2	D-5	0-2	IN	HAND BORING	M	Mercury	ND	.u	mg/kg	0.1
HB6-SS2	D-5	0-2	IN	HAND BORING	M	Nickel	25		mg/kg	1
HB6-SS2	D-5	0-2	IN	HAND BORING	M	Selenium	ND	N	mg/kg	0.5
HB6-SS2	D-5	0-2	IN	HAND BORING	M	Silver	ND		mg/kg	1
HB6-SS2	D-5	0-2	IN	HAND BORING	M	Thallium	ND		mg/kg	10
HB6-SS2	D-5	0-2	IN	HAND BORING	M	Zinc	86	N	mg/kg	1
HB6-SS3	D-5	3-5	IN	HAND BORING	V	ALL VOLATILES	ND	NA	ug/kg	NA
HB6-SS3	D-5	3-5	IN	HAND BORING	SV	ALL SEMI-VOLATILES	ND	NA	ug/kg	NA
HB6-SS3	D-5	3-5	IN	HAND BORING	M	Antimony	ND	N	mg/kg	6
HB6-SS3	D-5	3-5	IN	HAND BORING	M	Arsenic	13		mg/kg	0.5
HB6-SS3	D-5	3-5	IN	HAND BORING	M	Beryllium	0.6		mg/kg	0.1
HB6-SS3	D-5	3-5	IN	HAND BORING	M	Cadmium	ND		mg/kg	1
HB6-SS3	D-5	3-5	IN	HAND BORING	M	Chromium	14		mg/kg	1
HB6-SS3	D-5	3-5	IN	HAND BORING	M	Copper	25		mg/kg	1
HB6-SS3	D-5	3-5	IN	HAND BORING	M	Lead	15	*	mg/kg	5
HB6-SS3	D-5	3-5	IN	HAND BORING	M	Mercury	ND	u	mg/kg	0.1
HB6-SS3	D-5	3-5	IN	HAND BORING	M	Nickel	25		mg/kg	1
HB6-SS3	D-5	3-5	IN	HAND BORING	M	Selenium	ND	N	mg/kg	0.5
HB6-SS3	D-5	3-5	IN	HAND BORING	M	Silver	ND		mg/kg	1
HB6-SS3	D-5	3-5	IN	HAND BORING	M	Thallium	ND		mg/kg	10
HB6-SS3	D-5	3-5	IN	HAND BORING	M	Zinc	92	N	mg/kg	1

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – SOIL

SAMPLE #	GRID #	DEPTH	IN/OUT	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUALIFIER	UNITS	DETECTION LIMIT
MW1-SS1	C-6	13-15	IN	MONITORING WELL	V	Ethylbenzene	1700		ug/kg	5
MW1-SS1	C-6	13-15	IN	MONITORING WELL	V	o-Xylene	1600		ug/kg	5
MW1-SS1	C-6	13-15	IN	MONITORING WELL	SV	ALL SEMI-VOLATILES	ND	NA	ug/kg	NA
MW1-SS1	C-6	13-15	IN	MONITORING WELL	M	Antimony	ND	N	mg/kg	6
MW1-SS1	C-6	13-15	IN	MONITORING WELL	M	Arsenic	7.0	N	mg/kg	0.5
MW1-SS1	C-6	13-15	IN	MONITORING WELL	M	Beryllium	ND	N	mg/kg	0.1
MW1-SS1	C-6	13-15	IN	MONITORING WELL	M	Cadmium	ND	N	mg/kg	1
MW1-SS1	C-6	13-15	IN	MONITORING WELL	M	Chromium	4.5	B	mg/kg	1
MW1-SS1	C-6	13-15	IN	MONITORING WELL	M	Copper	12.7	N	mg/kg	1
MW1-SS1	C-6	13-15	IN	MONITORING WELL	M	Lead	ND	N	mg/kg	5
MW1-SS1	C-6	13-15	IN	MONITORING WELL	M	Mercury	DNU		mg/kg	0.1
MW1-SS1	C-6	13-15	IN	MONITORING WELL	M	Nickel	13.3	N	mg/kg	1
MW1-SS1	C-6	13-15	IN	MONITORING WELL	M	Selenium	ND	W	mg/kg	0.5
MW1-SS1	C-6	13-15	IN	MONITORING WELL	M	Silver	ND	N	mg/kg	1
MW1-SS1	C-6	13-15	IN	MONITORING WELL	M	Thallium	ND	N	mg/kg	10
MW1-SS1	C-6	13-15	IN	MONITORING WELL	M	Zinc	56.1	N	mg/kg	1
MW1-SS2	C-6	14-16	IN	MONITORING WELL	V	Benzene	1900		ug/kg	5
MW1-SS2	C-6	14-16	IN	MONITORING WELL	V	Ethylbenzene	11000		ug/kg	5
MW1-SS2	C-6	14-16	IN	MONITORING WELL	V	o-Xylene	20000		ug/kg	5
MW1-SS2	C-6	14-16	IN	MONITORING WELL	SV	Naphthalene	630		ug/kg	330
MW1-SS2	C-6	14-16	IN	MONITORING WELL	SV	2-Methylnaphthalene	1200		ug/kg	330
MW1-SS2	C-6	14-16	IN	MONITORING WELL	M	Antimony	ND	N	mg/kg	6
MW1-SS2	C-6	14-16	IN	MONITORING WELL	M	Arsenic	10.9	N	mg/kg	0.5
MW1-SS2	C-6	14-16	IN	MONITORING WELL	M	Beryllium	ND	N	mg/kg	0.1
MW1-SS2	C-6	14-16	IN	MONITORING WELL	M	Cadmium	ND	N	mg/kg	1
MW1-SS2	C-6	14-16	IN	MONITORING WELL	M	Chromium	8.4	N	mg/kg	1
MW1-SS2	C-6	14-16	IN	MONITORING WELL	M	Copper	17.2	N	mg/kg	1
MW1-SS2	C-6	14-16	IN	MONITORING WELL	M	Lead	8.6	B	mg/kg	5
MW1-SS2	C-6	14-16	IN	MONITORING WELL	M	Mercury	DNU		mg/kg	0.1
MW1-SS2	C-6	14-16	IN	MONITORING WELL	M	Nickel	22.2	N	mg/kg	1
MW1-SS2	C-6	14-16	IN	MONITORING WELL	M	Selenium	ND	W	mg/kg	0.5
MW1-SS2	C-6	14-16	IN	MONITORING WELL	M	Silver	ND	N	mg/kg	1
MW1-SS2	C-6	14-16	IN	MONITORING WELL	M	Thallium	ND	N	mg/kg	10
MW1-SS2	C-6	14-16	IN	MONITORING WELL	M	Zinc	63.8		mg/kg	1

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – SOIL

SAMPLE #	GRID #	DEPTH	IN/OUT	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUALIFIER	UNITS	DETECTION LIMIT
MW2-SS1	B-7	0-2	OUT	MONITORING WELL	V	ALL VOLATILES	ND	NA	ug/kg	NA
MW2-SS1	B-7	0-2	OUT	MONITORING WELL	SV	ALL SEMI-VOLATILES	ND	NA	ug/kg	NA
MW2-SS1	B-7	0-2	OUT	MONITORING WELL	M	Antimony	ND	N	mg/kg	6
MW2-SS1	B-7	0-2	OUT	MONITORING WELL	M	Arsenic	15	N	mg/kg	0.5
MW2-SS1	B-7	0-2	OUT	MONITORING WELL	M	Beryllium	ND		mg/kg	0.1
MW2-SS1	B-7	0-2	OUT	MONITORING WELL	M	Cadmium	ND		mg/kg	1
MW2-SS1	B-7	0-2	OUT	MONITORING WELL	M	Chromium	15		mg/kg	1
MW2-SS1	B-7	0-2	OUT	MONITORING WELL	M	Copper	21		mg/kg	1
MW2-SS1	B-7	0-2	OUT	MONITORING WELL	M	Lead	17		mg/kg	5
MW2-SS1	B-7	0-2	OUT	MONITORING WELL	M	Mercury	ND		mg/kg	0.1
MW2-SS1	B-7	0-2	OUT	MONITORING WELL	M	Nickel	25		mg/kg	1
MW2-SS1	B-7	0-2	OUT	MONITORING WELL	M	Selenium	ND	N	mg/kg	0.5
MW2-SS1	B-7	0-2	OUT	MONITORING WELL	M	Silver	ND		mg/kg	1
MW2-SS1	B-7	0-2	OUT	MONITORING WELL	M	Thallium	ND		mg/kg	10
MW2-SS1	B-7	0-2	OUT	MONITORING WELL	M	Zinc	66	N	mg/kg	1
MW2-SS2	B-7	0-2	OUT	MONITORING WELL	V	Methylene Chloride	5		ug/kg	5
MW2-SS2	B-7	0-2	OUT	MONITORING WELL	SV	ALL SEMI-VOLATILES	ND	NA	ug/kg	NA
MW2-SS2	B-7	0-2	OUT	MONITORING WELL	M	Antimony	ND	N	mg/kg	6
MW2-SS2	B-7	0-2	OUT	MONITORING WELL	M	Arsenic	7.6	N	mg/kg	0.5
MW2-SS2	B-7	0-2	OUT	MONITORING WELL	M	Beryllium	0.2	B	mg/kg	0.1
MW2-SS2	B-7	0-2	OUT	MONITORING WELL	M	Cadmium	ND		mg/kg	1
MW2-SS2	B-7	0-2	OUT	MONITORING WELL	M	Chromium	12		mg/kg	1
MW2-SS2	B-7	0-2	OUT	MONITORING WELL	M	Copper	21		mg/kg	1
MW2-SS2	B-7	0-2	OUT	MONITORING WELL	M	Lead	31		mg/kg	5
MW2-SS2	B-7	0-2	OUT	MONITORING WELL	M	Mercury	ND		mg/kg	0.1
MW2-SS2	B-7	0-2	OUT	MONITORING WELL	M	Nickel	21		mg/kg	1
MW2-SS2	B-7	0-2	OUT	MONITORING WELL	M	Selenium	ND	N	mg/kg	0.5
MW2-SS2	B-7	0-2	OUT	MONITORING WELL	M	Silver	ND		mg/kg	1
MW2-SS2	B-7	0-2	OUT	MONITORING WELL	M	Thallium	ND		mg/kg	10
MW2-SS2	B-7	0-2	OUT	MONITORING WELL	M	Zinc	74	N	mg/kg	1

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – SOIL

SAMPLE #	GRID #	DEPTH	IN/OUT	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUALIFIER	UNITS	DETECTION LIMIT
MW2-SS3	B-7	3-5	OUT	MONITORING WELL	V	Methylene Chloride	5		ug/kg	5
MW2-SS3	B-7	3-5	OUT	MONITORING WELL	SV	ALL SEMI-VOLATILES	ND	NA	ug/kg	NA
MW2-SS3	B-7	3-5	OUT	MONITORING WELL	M	Antimony	ND	N	mg/kg	6
MW2-SS3	B-7	3-5	OUT	MONITORING WELL	M	Arsenic	6.6	N	mg/kg	0.5
MW2-SS3	B-7	3-5	OUT	MONITORING WELL	M	Beryllium	ND		mg/kg	0.1
MW2-SS3	B-7	3-5	OUT	MONITORING WELL	M	Cadmium	ND		mg/kg	1
MW2-SS3	B-7	3-5	OUT	MONITORING WELL	M	Chromium	8		mg/kg	1
MW2-SS3	B-7	3-5	OUT	MONITORING WELL	M	Copper	24		mg/kg	1
MW2-SS3	B-7	3-5	OUT	MONITORING WELL	M	Lead	26		mg/kg	5
MW2-SS3	B-7	3-5	OUT	MONITORING WELL	M	Mercury	ND		mg/kg	0.1
MW2-SS3	B-7	3-5	OUT	MONITORING WELL	M	Nickel	9.2	B	mg/kg	1
MW2-SS3	B-7	3-5	OUT	MONITORING WELL	M	Selenium	ND	N	mg/kg	0.5
MW2-SS3	B-7	3-5	OUT	MONITORING WELL	M	Silver	ND		mg/kg	1
MW2-SS3	B-7	3-5	OUT	MONITORING WELL	M	Thallium	ND		mg/kg	10
MW2-SS3	B-7	3-5	OUT	MONITORING WELL	M	Zinc	76	N	mg/kg	1
MW3-SS1	C-4	0-2	IN	MONITORING WELL	SV	ALL SEMI-VOLATILES	ND	NA	ug/kg	NA
MW3-SS1	C-4	0-2	IN	MONITORING WELL	M	Antimony	ND	N	mg/kg	6
MW3-SS1	C-4	0-2	IN	MONITORING WELL	M	Arsenic	15.3		mg/kg	0.5
MW3-SS1	C-4	0-2	IN	MONITORING WELL	M	Beryllium	ND	N	mg/kg	0.1
MW3-SS1	C-4	0-2	IN	MONITORING WELL	M	Cadmium	ND		mg/kg	1
MW3-SS1	C-4	0-2	IN	MONITORING WELL	M	Chromium	13.1		mg/kg	1
MW3-SS1	C-4	0-2	IN	MONITORING WELL	M	Copper	20.5		mg/kg	1
MW3-SS1	C-4	0-2	IN	MONITORING WELL	M	Lead	15.6		mg/kg	5
MW3-SS1	C-4	0-2	IN	MONITORING WELL	M	Mercury	ND		mg/kg	0.1
MW3-SS1	C-4	0-2	IN	MONITORING WELL	M	Nickel	24.1		mg/kg	1
MW3-SS1	C-4	0-2	IN	MONITORING WELL	M	Selenium	ND	W	mg/kg	0.5
MW3-SS1	C-4	0-2	IN	MONITORING WELL	M	Silver	ND	N	mg/kg	1
MW3-SS1	C-4	0-2	IN	MONITORING WELL	M	Thallium	ND		mg/kg	10
MW3-SS1	C-4	0-2	IN	MONITORING WELL	M	Zinc	07.1		mg/kg	1

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – SOIL

SAMPLE #	GRID #	DEPTH	IN/OUT	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUALIFIER	UNITS	DETECTION LIMIT
MW3-SS2	C-4	0-10	IN	MONITORING WELL	SV	ALL SEMI-VOLATILES	ND	NA	ug/kg	NA
MW3-SS2	C-4	0-10	IN	MONITORING WELL	M	Antimony	ND	N	mg/kg	6
MW3-SS2	C-4	0-10	IN	MONITORING WELL	M	Arsenic	10.1		mg/kg	0.5
MW3-SS2	C-4	0-10	IN	MONITORING WELL	M	Beryllium	ND	N	mg/kg	0.1
MW3-SS2	C-4	0-10	IN	MONITORING WELL	M	Cadmium	ND		mg/kg	1
MW3-SS2	C-4	0-10	IN	MONITORING WELL	M	Chromium	14.1		mg/kg	1
MW3-SS2	C-4	0-10	IN	MONITORING WELL	M	Copper	19.1		mg/kg	1
MW3-SS2	C-4	0-10	IN	MONITORING WELL	M	Lead	13.7		mg/kg	5
MW3-SS2	C-4	0-10	IN	MONITORING WELL	M	Mercury	ND		mg/kg	0.1
MW3-SS2	C-4	0-10	IN	MONITORING WELL	M	Nickel	24.9		mg/kg	1
MW3-SS2	C-4	0-10	IN	MONITORING WELL	M	Selenium	ND		mg/kg	0.5
MW3-SS2	C-4	0-10	IN	MONITORING WELL	M	Silver	ND	N	mg/kg	1
MW3-SS2	C-4	0-10	IN	MONITORING WELL	M	Thallium	10.5		mg/kg	10
MW3-SS2	C-4	0-10	IN	MONITORING WELL	M	Zinc	83.7		mg/kg	1
SU1+2-GS1	B-2,C-2	0-2	IN	SURFACE SOIL SAMPLE	SV	Benzo(k)Fluoranthene	500		ug/kg	330
SU1+2-GS1	B-2,C-2	0-2	IN	SURFACE SOIL SAMPLE	SV	Fluoranthene	420		ug/kg	330
SU1+2-GS1	B-2,C-2	0-2	IN	SURFACE SOIL SAMPLE	M	Antimony	ND	N	mg/kg	6
SU1+2-GS1	B-2,C-2	0-2	IN	SURFACE SOIL SAMPLE	M	Arsenic	14.1		mg/kg	0.5
SU1+2-GS1	B-2,C-2	0-2	IN	SURFACE SOIL SAMPLE	M	Beryllium	0.79		mg/kg	0.1
SU1+2-GS1	B-2,C-2	0-2	IN	SURFACE SOIL SAMPLE	M	Cadmium	6.3	G	mg/kg	1
SU1+2-GS1	B-2,C-2	0-2	IN	SURFACE SOIL SAMPLE	M	Chromium	22.1		mg/kg	1
SU1+2-GS1	B-2,C-2	0-2	IN	SURFACE SOIL SAMPLE	M	Copper	29.3		mg/kg	1
SU1+2-GS1	B-2,C-2	0-2	IN	SURFACE SOIL SAMPLE	M	Lead	41.9		mg/kg	5
SU1+2-GS1	B-2,C-2	0-2	IN	SURFACE SOIL SAMPLE	M	Mercury	ND		mg/kg	0.1
SU1+2-GS1	B-2,C-2	0-2	IN	SURFACE SOIL SAMPLE	M	Nickel	28.2		mg/kg	1
SU1+2-GS1	B-2,C-2	0-2	IN	SURFACE SOIL SAMPLE	M	Selenium	ND	W	mg/kg	0.5
SU1+2-GS1	B-2,C-2	0-2	IN	SURFACE SOIL SAMPLE	M	Silver	ND		mg/kg	1
SU1+2-GS1	B-2,C-2	0-2	IN	SURFACE SOIL SAMPLE	M	Thallium	ND		mg/kg	10
SU1+2-GS1	B-2,C-2	0-2	IN	SURFACE SOIL SAMPLE	M	Zinc	422		mg/kg	1

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – SOIL

SAMPLE #	GRID #	DEPTH	IN/OUT	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUALIFIER	UNITS	DETECTION LIMIT
SU3+4-GS1	D-2,D-3	0-2	IN	SURFACE SOIL SAMPLE	SV	Benzo(k)Fluoranthene	500		ug/kg	330
SU3+4-GS1	D-2,D-3	0-2	IN	SURFACE SOIL SAMPLE	SV	Fluoranthene	570		ug/kg	330
SU3+4-GS1	D-2,D-3	0-2	IN	SURFACE SOIL SAMPLE	M	Antimony	ND	N	mg/kg	6
SU3+4-GS1	D-2,D-3	0-2	IN	SURFACE SOIL SAMPLE	M	Arsenic	19.7		mg/kg	0.5
SU3+4-GS1	D-2,D-3	0-2	IN	SURFACE SOIL SAMPLE	M	Beryllium	0.8		mg/kg	0.1
SU3+4-GS1	D-2,D-3	0-2	IN	SURFACE SOIL SAMPLE	M	Cadmium	8.3	G	mg/kg	1
SU3+4-GS1	D-2,D-3	0-2	IN	SURFACE SOIL SAMPLE	M	Chromium	22.4		mg/kg	1
SU3+4-GS1	D-2,D-3	0-2	IN	SURFACE SOIL SAMPLE	M	Copper	28.1		mg/kg	1
SU3+4-GS1	D-2,D-3	0-2	IN	SURFACE SOIL SAMPLE	M	Lead	35.3		mg/kg	5
SU3+4-GS1	D-2,D-3	0-2	IN	SURFACE SOIL SAMPLE	M	Mercury	ND		mg/kg	0.1
SU3+4-GS1	D-2,D-3	0-2	IN	SURFACE SOIL SAMPLE	M	Nickel	28.3		mg/kg	1
SU3+4-GS1	D-2,D-3	0-2	IN	SURFACE SOIL SAMPLE	M	Selenium	ND		mg/kg	0.5
SU3+4-GS1	D-2,D-3	0-2	IN	SURFACE SOIL SAMPLE	M	Silver	ND		mg/kg	1
SU3+4-GS1	D-2,D-3	0-2	IN	SURFACE SOIL SAMPLE	M	Thallium	ND		mg/kg	10
SU3+4-GS1	D-2,D-3	0-2	IN	SURFACE SOIL SAMPLE	M	Zinc	134		mg/kg	1

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – SOIL

SAMPLE #	GRID #	DEPTH	IN/OUT	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUALIFIER	UNITS	DETECTION LIMIT
SU5+6-GS1	B-3,C-3	0-2	IN	SURFACE SOIL SAMPLE	SV	Anthracene	580		ug/kg	330
SU5+6-GS1	B-3,C-3	0-2	IN	SURFACE SOIL SAMPLE	SV	Benzo(a)Anthracene	2100		ug/kg	330
SU5+6-GS1	B-3,C-3	0-2	IN	SURFACE SOIL SAMPLE	SV	Benzo(a)Pyrene	2600		ug/kg	330
SU5+6-GS1	B-3,C-3	0-2	IN	SURFACE SOIL SAMPLE	SV	Benzo(b)Fluoranthene	3200		ug/kg	330
SU5+6-GS1	B-3,C-3	0-2	IN	SURFACE SOIL SAMPLE	SV	Benzo(g,h,i)Perylene	1700		ug/kg	330
SU5+6-GS1	B-3,C-3	0-2	IN	SURFACE SOIL SAMPLE	SV	Benzo(k)Fluoranthene	2000		ug/kg	330
SU5+6-GS1	B-3,C-3	0-2	IN	SURFACE SOIL SAMPLE	SV	Bis(2-ethylhexyl)Phthalate	4100		ug/kg	330
SU5+6-GS1	B-3,C-3	0-2	IN	SURFACE SOIL SAMPLE	SV	Chrysene	2000		ug/kg	330
SU5+6-GS1	B-3,C-3	0-2	IN	SURFACE SOIL SAMPLE	SV	Dibenz(a,h)Anthracene	360		ug/kg	330
SU5+6-GS1	B-3,C-3	0-2	IN	SURFACE SOIL SAMPLE	SV	Fluoranthene	4100		ug/kg	330
SU5+6-GS1	B-3,C-3	0-2	IN	SURFACE SOIL SAMPLE	SV	Indeno(1,2,3-cd)Pyrene	1700		ug/kg	330
SU5+6-GS1	B-3,C-3	0-2	IN	SURFACE SOIL SAMPLE	SV	Phenanthrene	4200		ug/kg	330
SU5+6-GS1	B-3,C-3	0-2	IN	SURFACE SOIL SAMPLE	SV	Pyrene	5600		ug/kg	330
SU5+6-GS1	B-3,C-3	0-2	IN	SURFACE SOIL SAMPLE	M	Antimony	ND	N	mg/kg	6
SU5+6-GS1	B-3,C-3	0-2	IN	SURFACE SOIL SAMPLE	M	Arsenic	17.7	S	mg/kg	0.5
SU5+6-GS1	B-3,C-3	0-2	IN	SURFACE SOIL SAMPLE	M	Beryllium	0.75		mg/kg	0.1
SU5+6-GS1	B-3,C-3	0-2	IN	SURFACE SOIL SAMPLE	M	Cadmium	0.9	G	mg/kg	1
SU5+6-GS1	B-3,C-3	0-2	IN	SURFACE SOIL SAMPLE	M	Chromium	25.6		mg/kg	1
SU5+6-GS1	B-3,C-3	0-2	IN	SURFACE SOIL SAMPLE	M	Copper	57.9		mg/kg	1
SU5+6-GS1	B-3,C-3	0-2	IN	SURFACE SOIL SAMPLE	M	Lead	107		mg/kg	5
SU5+6-GS1	B-3,C-3	0-2	IN	SURFACE SOIL SAMPLE	M	Mercury	ND		mg/kg	0.1
SU5+6-GS1	B-3,C-3	0-2	IN	SURFACE SOIL SAMPLE	M	Nickel	19.1		mg/kg	1
SU5+6-GS1	B-3,C-3	0-2	IN	SURFACE SOIL SAMPLE	M	Selenium	ND	W	mg/kg	0.5
SU5+6-GS1	B-3,C-3	0-2	IN	SURFACE SOIL SAMPLE	M	Silver	ND		mg/kg	1
SU5+6-GS1	B-3,C-3	0-2	IN	SURFACE SOIL SAMPLE	M	Thallium	ND		mg/kg	10
SU5+6-GS1	B-3,C-3	0-2	IN	SURFACE SOIL SAMPLE	M	Zinc	433		mg/kg	1

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA

ANALYTICAL RESULTS – SOIL

SAMPLE #	GRID #	DEPTH	IN/OUT	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUALIFIER	UNITS	DETECTION LIMIT
SU7+8-GS1	B-4,C-4	0-2	IN	SURFACE SOIL SAMPLE	SV	Benzo(b)Fluoranthene	530		ug/kg	330
SU7+8-GS	B-4,C-4	0-2	IN	SURFACE SOIL SAMPLE	SV	Di-n-butyl Phthalate	940		ug/kg	330
SU7+8-GS	B-4,C-4	0-2	IN	SURFACE SOIL SAMPLE	SV	Fluoranthene	520		ug/kg	330
SU7+8-GS	B-4,C-4	0-2	IN	SURFACE SOIL SAMPLE	M	Antimony	ND	N	mg/kg	6
SU7+8-GS	B-4,C-4	0-2	IN	SURFACE SOIL SAMPLE	M	Arsenic	15.2		mg/kg	0.5
SU7+8-GS	B-4,C-4	0-2	IN	SURFACE SOIL SAMPLE	M	Beryllium	0.9		mg/kg	0.1
SU7+8-GS	B-4,C-4	0-2	IN	SURFACE SOIL SAMPLE	M	Cadmium	6	G	mg/kg	1
SU7+8-GS	B-4,C-4	0-2	IN	SURFACE SOIL SAMPLE	M	Chromium	22.1		mg/kg	1
SU7+8-GS	B-4,C-4	0-2	IN	SURFACE SOIL SAMPLE	M	Copper	23.1		mg/kg	1
SU7+8-GS	B-4,C-4	0-2	IN	SURFACE SOIL SAMPLE	M	Lead	55.7		mg/kg	5
SU7+8-GS	B-4,C-4	0-2	IN	SURFACE SOIL SAMPLE	M	Mercury	ND		mg/kg	0.1
SU7+8-GS	B-4,C-4	0-2	IN	SURFACE SOIL SAMPLE	M	Nickel	20.6		mg/kg	1
SU7+8-GS	B-4,C-4	0-2	IN	SURFACE SOIL SAMPLE	M	Selenium	ND		mg/kg	0.5
SU7+8-GS	B-4,C-4	0-2	IN	SURFACE SOIL SAMPLE	M	Silver	ND		mg/kg	1
SU7+8-GS	B-4,C-4	0-2	IN	SURFACE SOIL SAMPLE	M	Thallium	ND		mg/kg	10
SU7+8-GS	B-4,C-4	0-2	IN	SURFACE SOIL SAMPLE	M	Zinc	296		mg/kg	1
SU9+10-GS	D-4,E-4	0-2	IN	SURFACE SOIL SAMPLE	SV	Benzo(a)Pyrene	360		ug/kg	330
SU9+10-GS	D-4,E-4	0-2	IN	SURFACE SOIL SAMPLE	SV	Benzo(b)Fluoranthene	570		ug/kg	330
SU9+10-GS	D-4,E-4	0-2	IN	SURFACE SOIL SAMPLE	SV	Benzo(k)Fluoranthene	300		ug/kg	330
SU9+10-GS	D-4,E-4	0-2	IN	SURFACE SOIL SAMPLE	SV	Chrysene	420		ug/kg	330
SU9+10-GS	D-4,E-4	0-2	IN	SURFACE SOIL SAMPLE	SV	Fluoranthene	840		ug/kg	330
SU9+10-GS	D-4,E-4	0-2	IN	SURFACE SOIL SAMPLE	SV	Phenanthrene	410		ug/kg	330
SU9+10-GS	D-4,E-4	0-2	IN	SURFACE SOIL SAMPLE	SV	Pyrene	630		ug/kg	330
SU9+10-GS	D-4,E-4	0-2	IN	SURFACE SOIL SAMPLE	M	Antimony	ND	N	mg/kg	6
SU9+10-GS	D-4,E-4	0-2	IN	SURFACE SOIL SAMPLE	M	Arsenic	17.9		mg/kg	0.5
SU9+10-GS	D-4,E-4	0-2	IN	SURFACE SOIL SAMPLE	M	Beryllium	0.95		mg/kg	0.1
SU9+10-GS	D-4,E-4	0-2	IN	SURFACE SOIL SAMPLE	M	Cadmium	9.1	G	mg/kg	1
SU9+10-GS	D-4,E-4	0-2	IN	SURFACE SOIL SAMPLE	M	Chromium	20.1		mg/kg	1
SU9+10-GS	D-4,E-4	0-2	IN	SURFACE SOIL SAMPLE	M	Copper	73.1		mg/kg	1
SU9+10-GS	D-4,E-4	0-2	IN	SURFACE SOIL SAMPLE	M	Lead	72.0		mg/kg	5
SU9+10-GS	D-4,E-4	0-2	IN	SURFACE SOIL SAMPLE	M	Mercury	ND		mg/kg	0.1
SU9+10-GS	D-4,E-4	0-2	IN	SURFACE SOIL SAMPLE	M	Nickel	26.6		mg/kg	1
SU9+10-GS	D-4,E-4	0-2	IN	SURFACE SOIL SAMPLE	M	Selenium	ND		mg/kg	0.5
SU9+10-GS	D-4,E-4	0-2	IN	SURFACE SOIL SAMPLE	M	Silver	ND		mg/kg	1
SU9+10-GS	D-4,E-4	0-2	IN	SURFACE SOIL SAMPLE	M	Thallium	ND		mg/kg	10
SU9+10-GS	D-4,E-4	0-2	IN	SURFACE SOIL SAMPLE	M	Zinc	260		mg/kg	1

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – SOIL

SAMPLE #	GRID #	DEPTH	IN/OUT	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUALIFIER	UNITS	DETECTION LIMIT
SU11+12-GS	C-5,D-5	0-2	IN	SURFACE SOIL SAMPLE	SV	Benzo(a)Pyrene	530		ug/kg	330
SU11+12-GS	C-5,D-5	0-2	IN	SURFACE SOIL SAMPLE	SV	Benzo(b)Fluoranthene	850		ug/kg	330
SU11+12-GS	C-5,D-5	0-2	IN	SURFACE SOIL SAMPLE	SV	Benzo(k)Fluoranthene	460		ug/kg	330
SU11+12-GS	C-5,D-5	0-2	IN	SURFACE SOIL SAMPLE	SV	Bis(2-ethylhexyl)Phthalate	480		ug/kg	330
SU11+12-GS	C-5,D-5	0-2	IN	SURFACE SOIL SAMPLE	SV	Chrysene	540		ug/kg	330
SU11+12-GS	C-5,D-5	0-2	IN	SURFACE SOIL SAMPLE	SV	Di-n-butyl Phthalate	6500		ug/kg	330
SU11+12-GS	C-5,D-5	0-2	IN	SURFACE SOIL SAMPLE	SV	Fluorene	1400		ug/kg	330
SU11+12-GS	C-5,D-5	0-2	IN	SURFACE SOIL SAMPLE	SV	Phenanthrene	1100		ug/kg	330
SU11+12-GS	C-5,D-5	0-2	IN	SURFACE SOIL SAMPLE	SV	Pyrene	1000		ug/kg	330
SU11+12-GS	C-5,D-5	0-2	IN	SURFACE SOIL SAMPLE	M	Antimony	ND	N	mg/kg	6
SU11+12-GS	C-5,D-5	0-2	IN	SURFACE SOIL SAMPLE	M	Arsenic	17.7		mg/kg	0.5
SU11+12-GS	C-5,D-5	0-2	IN	SURFACE SOIL SAMPLE	M	Beryllium	0.78		mg/kg	0.1
SU11+12-GS	C-5,D-5	0-2	IN	SURFACE SOIL SAMPLE	M	Cadmium	8	G	mg/kg	1
SU11+12-GS	C-5,D-5	0-2	IN	SURFACE SOIL SAMPLE	M	Chromium	19.5		mg/kg	1
SU11+12-GS	C-5,D-5	0-2	IN	SURFACE SOIL SAMPLE	M	Copper	29.7		mg/kg	1
SU11+12-GS	C-5,D-5	0-2	IN	SURFACE SOIL SAMPLE	M	Lead	35		mg/kg	5
SU11+12-GS	C-5,D-5	0-2	IN	SURFACE SOIL SAMPLE	M	Mercury	ND		mg/kg	0.1
SU11+12-GS	C-5,D-5	0-2	IN	SURFACE SOIL SAMPLE	M	Nickel	26.5		mg/kg	1
SU11+12-GS	C-5,D-5	0-2	IN	SURFACE SOIL SAMPLE	M	Selenium	ND	S	mg/kg	0.5
SU11+12-GS	C-5,D-5	0-2	IN	SURFACE SOIL SAMPLE	M	Silver	ND		mg/kg	1
SU11+12-GS	C-5,D-5	0-2	IN	SURFACE SOIL SAMPLE	M	Thallium	ND		mg/kg	10
SU11+12-GS	C-5,D-5	0-2	IN	SURFACE SOIL SAMPLE	M	Zinc	113		mg/kg	1
SU13+14-GS	B-6,C-5	0-2	IN	SURFACE SOIL SAMPLE	SV	Benzo(b)Fluoranthene	430		ug/kg	330
SU13+14-GS	B-6,C-5	0-2	IN	SURFACE SOIL SAMPLE	SV	Fluoranthene	440		ug/kg	330
SU13+14-GS	B-6,C-5	0-2	IN	SURFACE SOIL SAMPLE	M	Antimony	ND	N	mg/kg	6
SU13+14-GS	B-6,C-5	0-2	IN	SURFACE SOIL SAMPLE	M	Arsenic	12.8		mg/kg	0.5
SU13+14-GS	B-6,C-5	0-2	IN	SURFACE SOIL SAMPLE	M	Beryllium	0.89		mg/kg	0.1
SU13+14-GS	B-6,C-5	0-2	IN	SURFACE SOIL SAMPLE	M	Cadmium	7.7	G	mg/kg	1
SU13+14-GS	B-6,C-5	0-2	IN	SURFACE SOIL SAMPLE	M	Chromium	19.6		mg/kg	1
SU13+14-GS	B-6,C-5	0-2	IN	SURFACE SOIL SAMPLE	M	Copper	19.7		mg/kg	1
SU13+14-GS	B-6,C-5	0-2	IN	SURFACE SOIL SAMPLE	M	Lead	41.5		mg/kg	5
SU13+14-GS	B-6,C-5	0-2	IN	SURFACE SOIL SAMPLE	M	Mercury	ND		mg/kg	0.1
SU13+14-GS	B-6,C-5	0-2	IN	SURFACE SOIL SAMPLE	M	Nickel	14.8		mg/kg	1
SU13+14-GS	B-6,C-5	0-2	IN	SURFACE SOIL SAMPLE	M	Selenium	ND		mg/kg	0.5
SU13+14-GS	B-6,C-5	0-2	IN	SURFACE SOIL SAMPLE	M	Silver	ND		mg/kg	1
SU13+14-GS	B-6,C-5	0-2	IN	SURFACE SOIL SAMPLE	M	Thallium	ND		mg/kg	10
SU13+14-GS	B-6,C-5	0-2	IN	SURFACE SOIL SAMPLE	M	Zinc	120		mg/kg	1

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – SOIL

SAMPLE #	GRID #	DEPTH	IN/OUT	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUALIFIER	UNITS	DETECTION LIMIT
SU15+16-GS	C-6,D-6	0-2	IN	SURFACE SOIL SAMPLE	SV	Benzo(b)Fluoranthene	840		ug/kg	330
SU15+16-GS	C-6,D-6	0-2	IN	SURFACE SOIL SAMPLE	SV	Fluoranthene	740		ug/kg	330
SU15+16-GS	C-6,D-6	0-2	IN	SURFACE SOIL SAMPLE	SV	Pyrene	520		ug/kg	330
SU15+16-GS	C-6,D-6	0-2	IN	SURFACE SOIL SAMPLE	M	Antimony	ND	N	mg/kg	6
SU15+16-GS	C-6,D-6	0-2	IN	SURFACE SOIL SAMPLE	M	Arsenic	17.2		mg/kg	0.5
SU15+16-GS	C-6,D-6	0-2	IN	SURFACE SOIL SAMPLE	M	Beryllium	0.75		mg/kg	0.1
SU15+16-GS	C-6,D-6	0-2	IN	SURFACE SOIL SAMPLE	M	Cadmium	7.7	G	mg/kg	1
SU15+16-GS	C-6,D-6	0-2	IN	SURFACE SOIL SAMPLE	M	Chromium	23.9		mg/kg	1
SU15+16-GS	C-6,D-6	0-2	IN	SURFACE SOIL SAMPLE	M	Copper	30.7		mg/kg	1
SU15+16-GS	C-6,D-6	0-2	IN	SURFACE SOIL SAMPLE	M	Lead	52.1		mg/kg	5
SU15+16-GS	C-6,D-6	0-2	IN	SURFACE SOIL SAMPLE	M	Mercury	ND		mg/kg	0.1
SU15+16-GS	C-6,D-6	0-2	IN	SURFACE SOIL SAMPLE	M	Nickel	28.4		mg/kg	1
SU15+16-GS	C-6,D-6	0-2	IN	SURFACE SOIL SAMPLE	M	Selenium	ND	W	mg/kg	0.5
SU15+16-GS	C-6,D-6	0-2	IN	SURFACE SOIL SAMPLE	M	Silver	ND		mg/kg	1
SU15+16-GS	C-6,D-6	0-2	IN	SURFACE SOIL SAMPLE	M	Thallium	ND		mg/kg	10
SU15+16-GS	C-6,D-6	0-2	IN	SURFACE SOIL SAMPLE	M	Zinc	135		mg/kg	1

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – GROUNDWATER

SAMPLE #	GRID #	YES/NO FILTERED	DATE	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUALIFIER	UNITS	DETECTION LIMIT
MW1-GW1	C-6		19-Sep-88	Groundwater Sample	V	Benzene	94		ug/L	5
MW1-GW1	C-6		19-Sep-88	Groundwater Sample	V	Acetone	120	U	ug/L	100
MW1-GW1	C-6		19-Sep-88	Groundwater Sample	SV	ALL SEMI-VOLATILES	ND	NA	ug/L	NA
MW1-GW1	C-6		19-Sep-88	Groundwater Sample	V	o-Xylene	20		ug/L	5
MW1-GW1	C-6		19-Sep-88	Groundwater Sample	M	Antimony	ND		mg/L	0.06
MW1-GW1	C-6		19-Sep-88	Groundwater Sample	M	Arsenic	0.34		mg/L	0.005
MW1-GW1	C-6		19-Sep-88	Groundwater Sample	M	Beryllium	ND	N	mg/L	0.001
MW1-GW1	C-6		19-Sep-88	Groundwater Sample	M	Cadmium	0.15		mg/L	0.01
MW1-GW1	C-6		19-Sep-88	Groundwater Sample	M	Chromium	0.52		mg/L	0.01
MW1-GW1	C-6		19-Sep-88	Groundwater Sample	M	Copper	0.88		mg/L	0.01
MW1-GW1	C-6		19-Sep-88	Groundwater Sample	M	Lead	0.82		mg/L	0.005
MW1-GW1	C-6		19-Sep-88	Groundwater Sample	M	Mercury	0.0003		mg/L	0.0002
MW1-GW1	C-6		19-Sep-88	Groundwater Sample	M	Nickel	0.84		mg/L	0.01
MW1-GW1	C-6		19-Sep-88	Groundwater Sample	M	Selenium	ND	T	mg/L	0.005
MW1-GW1	C-6		19-Sep-88	Groundwater Sample	M	Silver	ND	N	mg/L	0.01
MW1-GW1	C-6		19-Sep-88	Groundwater Sample	M	Thallium	ND		mg/L	0.1
MW1-GW1	C-6		19-Sep-88	Groundwater Sample	M	Zinc	3.6		mg/L	0.01
MW1-GW1D	C-6		19-Sep-88	Groundwater Sample	V	Benzene	34		ug/L	5
MW1-GW1D	C-6		19-Sep-88	Groundwater Sample	SV	2-Methylnapthalene	13		ug/L	10
MW1-GW1D	C-6		19-Sep-88	Groundwater Sample	M	Antimony	ND		mg/L	0.06
MW1-GW1D	C-6		19-Sep-88	Groundwater Sample	M	Arsenic	0.4		mg/L	0.005
MW1-GW1D	C-6		19-Sep-88	Groundwater Sample	M	Beryllium	ND	N	mg/L	0.001
MW1-GW1D	C-6		19-Sep-88	Groundwater Sample	M	Cadmium	0.18		mg/L	0.01
MW1-GW1D	C-6		19-Sep-88	Groundwater Sample	M	Chromium	0.66		mg/L	0.01
MW1-GW1D	C-6		19-Sep-88	Groundwater Sample	M	Copper	1.1		mg/L	0.01
MW1-GW1D	C-6		19-Sep-88	Groundwater Sample	M	Lead	0.99		mg/L	0.005
MW1-GW1D	C-6		19-Sep-88	Groundwater Sample	M	Mercury	0.0003		mg/L	0.0002
MW1-GW1D	C-6		19-Sep-88	Groundwater Sample	M	Nickel	1		mg/L	0.01
MW1-GW1D	C-6		19-Sep-88	Groundwater Sample	M	Selenium	ND	T	mg/L	0.005
MW1-GW1D	C-6		19-Sep-88	Groundwater Sample	M	Silver	ND	N	mg/L	0.01
MW1-GW1D	C-6		19-Sep-88	Groundwater Sample	M	Thallium	ND		mg/L	0.1
MW1-GW1D	C-6		19-Sep-88	Groundwater Sample	M	Zinc	4.3		mg/L	0.01

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – GROUNDWATER

SAMPLE #	GRID #	YES/NO FILTERED	DATE	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUALIFIER	UNITS	DETECTION LIMIT
MW2-GW1	B-7		19-Sep-88	Groundwater Sample	V	ALL VOLATILES	ND	NA	ug/L	NA
MW2-GW1	B-7		19-Sep-88	Groundwater Sample	SV	ALL SEMI-VOLATILES	ND	NA	ug/L	NA
MW2-GW1	B-7		19-Sep-88	Groundwater Sample	M	Antimony	ND		mg/L	0.06
MW2-GW1	B-7		19-Sep-88	Groundwater Sample	M	Arsenic	0.184		mg/L	0.005
MW2-GW1	B-7		19-Sep-88	Groundwater Sample	M	Beryllium	ND	N	mg/L	0.001
MW2-GW1	B-7		19-Sep-88	Groundwater Sample	M	Cadmium	0.12		mg/L	0.01
MW2-GW1	B-7		19-Sep-88	Groundwater Sample	M	Chromium	0.28		mg/L	0.01
MW2-GW1	B-7		19-Sep-88	Groundwater Sample	M	Copper	0.66		mg/L	0.01
MW2-GW1	B-7		19-Sep-88	Groundwater Sample	M	Lead	0.55		mg/L	0.005
MW2-GW1	B-7		19-Sep-88	Groundwater Sample	M	Mercury	0.0002		mg/L	0.0002
MW2-GW1	B-7		19-Sep-88	Groundwater Sample	M	Nickel	0.45		mg/L	0.01
MW2-GW1	B-7		19-Sep-88	Groundwater Sample	M	Selenium	ND	Y	mg/L	0.005
MW2-GW1	B-7		19-Sep-88	Groundwater Sample	M	Silver	ND	N	mg/L	0.01
MW2-GW1	B-7		19-Sep-88	Groundwater Sample	M	Thallium	ND		mg/L	0.1
MW2-GW1	B-7		19-Sep-88	Groundwater Sample	M	Zinc	2.4		mg/L	0.01
MW3-GW1	C-4		22-Sep-88	Groundwater Sample	V	Trichloroethylene	44		ug/L	5
MW3-GW1	C-4		22-Sep-88	Groundwater Sample	SV	ALL SEMI-VOLATILES	ND	NA	ug/L	NA
MW3-GW1	C-4		22-Sep-88	Groundwater Sample	M	Antimony	ND		mg/L	0.06
MW3-GW1	C-4		22-Sep-88	Groundwater Sample	M	Arsenic	0.14		mg/L	0.005
MW3-GW1	C-4		22-Sep-88	Groundwater Sample	M	Beryllium	ND	N	mg/L	0.001
MW3-GW1	C-4		22-Sep-88	Groundwater Sample	M	Cadmium	0.04		mg/L	0.01
MW3-GW1	C-4		22-Sep-88	Groundwater Sample	M	Chromium	0.16		mg/L	0.01
MW3-GW1	C-4		22-Sep-88	Groundwater Sample	M	Copper	0.2		mg/L	0.01
MW3-GW1	C-4		22-Sep-88	Groundwater Sample	M	Lead	0.19		mg/L	0.005
MW3-GW1	C-4		22-Sep-88	Groundwater Sample	M	Mercury	ND		mg/L	0.0002
MW3-GW1	C-4		22-Sep-88	Groundwater Sample	M	Nickel	0.27		mg/L	0.01
MW3-GW1	C-4		22-Sep-88	Groundwater Sample	M	Selenium	0.0082	S	mg/L	0.005
MW3-GW1	C-4		22-Sep-88	Groundwater Sample	M	Silver	ND	N	mg/L	0.01
MW3-GW1	C-4		22-Sep-88	Groundwater Sample	M	Thallium	ND		mg/L	0.1
MW3-GW1	C-4		22-Sep-88	Groundwater Sample	M	Zinc	0.94		mg/L	0.01
MW3-GW1	C-4		17-Oct-88	Groundwater Sample	SV	Bis(2-ethylhexyl)phthalat	24	B	ug/L	10

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – GROUNDWATER

SAMPLE #	GRID #	YES/NO FILTERED	DATE	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUALIFIER	UNITS	DETECTION LIMIT
MW1-GW2	C-6	NO	06-Feb-90	Groundwater Sample	M	Antimony	35.3	U	ug/L	60
MW1-GW2	C-6	NO	06-Feb-90	Groundwater Sample	M	Arsenic	9.5	B	ug/L	10
MW1-GW2	C-6	NO	06-Feb-90	Groundwater Sample	M	Beryllium	3.9	U	ug/L	5
MW1-GW2	C-6	NO	06-Feb-90	Groundwater Sample	M	Cadmium	4.9	U	ug/L	5
MW1-GW2	C-6	NO	06-Feb-90	Groundwater Sample	M	Chromium	70.4		ug/L	10
MW1-GW2	C-6	NO	06-Feb-90	Groundwater Sample	M	Copper	171		ug/L	25
MW1-GW2	C-6	NO	06-Feb-90	Groundwater Sample	M	Lead	195		ug/L	3
MW1-GW2	C-6	NO	06-Feb-90	Groundwater Sample	M	Mercury	0.1	U	ug/L	0.2
MW1-GW2	C-6	NO	06-Feb-90	Groundwater Sample	M	Nickel	121		ug/L	40
MW1-GW2	C-6	NO	06-Feb-90	Groundwater Sample	M	Selenium	5.5		ug/L	5
MW1-GW2	C-6	NO	06-Feb-90	Groundwater Sample	M	Silver	9.1	U	ug/L	10
MW1-GW2	C-6	NO	06-Feb-90	Groundwater Sample	M	Thallium	0.9	U	ug/L	10
MW1-GW2	C-6	NO	06-Feb-90	Groundwater Sample	M	Zinc	678		ug/L	20
MW1-GW2	C-6	YES	06-Feb-90	Groundwater Sample	M	Antimony	40.2	U	ug/L	60
MW1-GW2	C-6	YES	06-Feb-90	Groundwater Sample	M	Arsenic	9.4	B	ug/L	10
MW1-GW2	C-6	YES	06-Feb-90	Groundwater Sample	M	Beryllium	2.3	U	ug/L	5
MW1-GW2	C-6	YES	06-Feb-90	Groundwater Sample	M	Cadmium	1.9	U	ug/L	5
MW1-GW2	C-6	YES	06-Feb-90	Groundwater Sample	M	Chromium	8.7	U	ug/L	10
MW1-GW2	C-6	YES	06-Feb-90	Groundwater Sample	M	Copper	4.1	U	ug/L	25
MW1-GW2	C-6	YES	06-Feb-90	Groundwater Sample	M	Lead	7.7	SJ	ug/L	3
MW1-GW2	C-6	YES	06-Feb-90	Groundwater Sample	M	Mercury	0.11	B	ug/L	0.2
MW1-GW2	C-6	YES	06-Feb-90	Groundwater Sample	M	Nickel	23.6	U	ug/L	40
MW1-GW2	C-6	YES	06-Feb-90	Groundwater Sample	M	Selenium	1.7	U	ug/L	5
MW1-GW2	C-6	YES	06-Feb-90	Groundwater Sample	M	Silver	6.6	U	ug/L	10
MW1-GW2	C-6	YES	06-Feb-90	Groundwater Sample	M	Thallium	0.9	U	ug/L	10
MW1-GW2	C-6	YES	06-Feb-90	Groundwater Sample	M	Zinc	10	BJ	ug/L	20

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – GROUNDWATER

SAMPLE #	GRID #	YES/NO FILTERED	DATE	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUALIFIER	UNITS	DETECTION LIMIT
MW2-GW2	B-7	NO	07-Feb-90	Groundwater Sample	M	Antimony	40.2	U	ug/L	60
MW2-GW2	B-7	NO	07-Feb-90	Groundwater Sample	M	Arsenic	6.5	B	ug/L	10
MW2-GW2	B-7	NO	07-Feb-90	Groundwater Sample	M	Beryllium	2.3	U	ug/L	5
MW2-GW2	B-7	NO	07-Feb-90	Groundwater Sample	M	Cadmium	1.9	U	ug/L	5
MW2-GW2	B-7	NO	07-Feb-90	Groundwater Sample	M	Chromium	33		ug/L	10
MW2-GW2	B-7	NO	07-Feb-90	Groundwater Sample	M	Copper	101		ug/L	25
MW2-GW2	B-7	NO	07-Feb-90	Groundwater Sample	M	Lead	84.5	S	ug/L	3
MW2-GW2	B-7	NO	07-Feb-90	Groundwater Sample	M	Mercury	0.1	U	ug/L	0.2
MW2-GW2	B-7	NO	07-Feb-90	Groundwater Sample	M	Nickel	52		ug/L	40
MW2-GW2	B-7	NO	07-Feb-90	Groundwater Sample	M	Selenium	1.9	BW	ug/L	5
MW2-GW2	B-7	NO	07-Feb-90	Groundwater Sample	M	Silver	6.6	U	ug/L	10
MW2-GW2	B-7	NO	07-Feb-90	Groundwater Sample	M	Thallium	0.9	U	ug/L	10
MW2-GW2	B-7	NO	07-Feb-90	Groundwater Sample	M	Zinc	340		ug/L	20
MW2-GW2	B-7	YES	07-Feb-90	Groundwater Sample	M	Antimony	34.6	U	ug/L	60
MW2-GW2	B-7	YES	07-Feb-90	Groundwater Sample	M	Arsenic	4.2	BW	ug/L	10
MW2-GW2	B-7	YES	07-Feb-90	Groundwater Sample	M	Beryllium	3.8	U	ug/L	5
MW2-GW2	B-7	YES	07-Feb-90	Groundwater Sample	M	Cadmium	4.8	U	ug/L	5
MW2-GW2	B-7	YES	07-Feb-90	Groundwater Sample	M	Chromium	9.8	U	ug/L	10
MW2-GW2	B-7	YES	07-Feb-90	Groundwater Sample	M	Copper	6	U	ug/L	25
MW2-GW2	B-7	YES	07-Feb-90	Groundwater Sample	M	Lead	14	W	ug/L	3
MW2-GW2	B-7	YES	07-Feb-90	Groundwater Sample	M	Mercury	0.1	U	ug/L	0.2
MW2-GW2	B-7	YES	07-Feb-90	Groundwater Sample	M	Nickel	31.1	U	ug/L	40
MW2-GW2	B-7	YES	07-Feb-90	Groundwater Sample	M	Selenium	1.4	U	ug/L	5
MW2-GW2	B-7	YES	07-Feb-90	Groundwater Sample	M	Silver	8.9	U	ug/L	10
MW2-GW2	B-7	YES	07-Feb-90	Groundwater Sample	M	Thallium	0.9	U	ug/L	10
MW2-GW2	B-7	YES	07-Feb-90	Groundwater Sample	M	Zinc	18	BJ	ug/L	20

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – GROUNDWATER

SAMPLE #	GRID #	YES/NO FILTERED	DATE	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUALIFIER	UNITS	DETECTION LIMIT
MW3-GW2	C-4	NO	06-Feb-90	Groundwater Sample	M	Antimony	40.2	U	ug/L	60
MW3-GW2	C-4	NO	06-Feb-90	Groundwater Sample	M	Arsenic	5.9	B	ug/L	10
MW3-GW2	C-4	NO	06-Feb-90	Groundwater Sample	M	Beryllium	2.3	U	ug/L	5
MW3-GW2	C-4	NO	06-Feb-90	Groundwater Sample	M	Cadmium	1.9	U	ug/L	5
MW3-GW2	C-4	NO	06-Feb-90	Groundwater Sample	M	Chromium	8.7	U	ug/L	10
MW3-GW2	C-4	NO	06-Feb-90	Groundwater Sample	M	Copper	7	B	ug/L	25
MW3-GW2	C-4	NO	06-Feb-90	Groundwater Sample	M	Lead	9.7	J	ug/L	3
MW3-GW2	C-4	NO	06-Feb-90	Groundwater Sample	M	Mercury	0.1	U	ug/L	0.2
MW3-GW2	C-4	NO	06-Feb-90	Groundwater Sample	M	Nickel	23.6	U	ug/L	40
MW3-GW2	C-4	NO	06-Feb-90	Groundwater Sample	M	Selenium	1.7	U	ug/L	5
MW3-GW2	C-4	NO	06-Feb-90	Groundwater Sample	M	Silver	6.6	U	ug/L	10
MW3-GW2	C-4	NO	06-Feb-90	Groundwater Sample	M	Thallium	0.9	U	ug/L	10
MW3-GW2	C-4	NO	06-Feb-90	Groundwater Sample	M	Zinc	35	J	ug/L	20
MW3-GW2	C-4	YES	06-Feb-90	Groundwater Sample	M	Antimony	34.6	U	ug/L	60
MW3-GW2	C-4	YES	06-Feb-90	Groundwater Sample	M	Arsenic	2	B	ug/L	10
MW3-GW2	C-4	YES	06-Feb-90	Groundwater Sample	M	Beryllium	3.8	U	ug/L	5
MW3-GW2	C-4	YES	06-Feb-90	Groundwater Sample	M	Cadmium	4.8	U	ug/L	5
MW3-GW2	C-4	YES	06-Feb-90	Groundwater Sample	M	Chromium	9.8	U	ug/L	10
MW3-GW2	C-4	YES	06-Feb-90	Groundwater Sample	M	Copper	6	U	ug/L	25
MW3-GW2	C-4	YES	06-Feb-90	Groundwater Sample	M	Lead	5.3		ug/L	3
MW3-GW2	C-4	YES	06-Feb-90	Groundwater Sample	M	Mercury	0.1	U	ug/L	0.2
MW3-GW2	C-4	YES	06-Feb-90	Groundwater Sample	M	Nickel	31.1	U	ug/L	40
MW3-GW2	C-4	YES	06-Feb-90	Groundwater Sample	M	Selenium	1.4	U	ug/L	5
MW3-GW2	C-4	YES	06-Feb-90	Groundwater Sample	M	Silver	8.9	U	ug/L	10
MW3-GW2	C-4	YES	06-Feb-90	Groundwater Sample	M	Thallium	0.9	U	ug/L	10
MW3-GW2	C-4	YES	06-Feb-90	Groundwater Sample	M	Zinc	17	BJ	ug/L	20

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – GROUNDWATER

SAMPLE #	GRID #	YES/NO FILTERED	DATE	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUALIFIER	UNITS	DETECTION LIMIT
MW4-GW1	B-2	NO	06-Feb-90	Groundwater Sample	M	Antimony	34.6	U	ug/L	60
MW4-GW1	B-2	NO	06-Feb-90	Groundwater Sample	M	Arsenic	18.5		ug/L	10
MW4-GW1	B-2	NO	06-Feb-90	Groundwater Sample	M	Beryllium	3.8	U	ug/L	5
MW4-GW1	B-2	NO	06-Feb-90	Groundwater Sample	M	Cadmium	4.8	U	ug/L	5
MW4-GW1	B-2	NO	06-Feb-90	Groundwater Sample	M	Chromium	39		ug/L	10
MW4-GW1	B-2	NO	06-Feb-90	Groundwater Sample	M	Copper	73		ug/L	25
MW4-GW1	B-2	NO	06-Feb-90	Groundwater Sample	M	Lead	27.1	S	ug/L	3
MW4-GW1	B-2	NO	06-Feb-90	Groundwater Sample	M	Mercury	0.1	U	ug/L	0.2
MW4-GW1	B-2	NO	06-Feb-90	Groundwater Sample	M	Nickel	73		ug/L	40
MW4-GW1	B-2	NO	06-Feb-90	Groundwater Sample	M	Selenium	1.5	BW	ug/L	5
MW4-GW1	B-2	NO	06-Feb-90	Groundwater Sample	M	Silver	8.9	U	ug/L	10
MW4-GW1	B-2	NO	06-Feb-90	Groundwater Sample	M	Thallium	0.9	U	ug/L	10
MW4-GW1	B-2	NO	06-Feb-90	Groundwater Sample	M	Zinc	340		ug/L	20
MW4-GW1	B-2	YES	06-Feb-90	Groundwater Sample	M	Antimony	40.2	U	ug/L	60
MW4-GW1	B-2	YES	06-Feb-90	Groundwater Sample	M	Arsenic	1.5	U	ug/L	10
MW4-GW1	B-2	YES	06-Feb-90	Groundwater Sample	M	Beryllium	2.3	U	ug/L	5
MW4-GW1	B-2	YES	06-Feb-90	Groundwater Sample	M	Cadmium	1.9	U	ug/L	5
MW4-GW1	B-2	YES	06-Feb-90	Groundwater Sample	M	Chromium	0.7	U	ug/L	10
MW4-GW1	B-2	YES	06-Feb-90	Groundwater Sample	M	Copper	4.1	U	ug/L	25
MW4-GW1	B-2	YES	06-Feb-90	Groundwater Sample	M	Lead	12.5		ug/L	3
MW4-GW1	B-2	YES	06-Feb-90	Groundwater Sample	M	Mercury	0.1	U	ug/L	0.2
MW4-GW1	B-2	YES	06-Feb-90	Groundwater Sample	M	Nickel	23.6	U	ug/L	40
MW4-GW1	B-2	YES	06-Feb-90	Groundwater Sample	M	Selenium	1.7	UW	ug/L	5
MW4-GW1	B-2	YES	06-Feb-90	Groundwater Sample	M	Silver	6.6	U	ug/L	10
MW4-GW1	B-2	YES	06-Feb-90	Groundwater Sample	M	Thallium	0.9	U	ug/L	10
MW4-GW1	B-2	YES	06-Feb-90	Groundwater Sample	M	Zinc	10	BJ	ug/L	20

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – GROUNDWATER

SAMPLE #	GRID #	YES/NO FILTERED	DATE	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUALIFIER	UNITS	DETECTION LIMIT
MW6-GW1	E-5	NO	07-Feb-90	Groundwater Sample	M	Antimony	35.3	U	ug/L	60
MW6-GW1	E-5	NO	07-Feb-90	Groundwater Sample	M	Arsenic	9.2	BW	ug/L	10
MW6-GW1	E-5	NO	07-Feb-90	Groundwater Sample	M	Beryllium	3.9	U	ug/L	5
MW6-GW1	E-5	NO	07-Feb-90	Groundwater Sample	M	Cadmium	4.9	U	ug/L	5
MW6-GW1	E-5	NO	07-Feb-90	Groundwater Sample	M	Chromium	32.6		ug/L	10
MW6-GW1	E-5	NO	07-Feb-90	Groundwater Sample	M	Copper	101		ug/L	25
MW6-GW1	E-5	NO	07-Feb-90	Groundwater Sample	M	Lead	84		ug/L	.3
MW6-GW1	E-5	NO	07-Feb-90	Groundwater Sample	M	Mercury	0.1	U	ug/L	0.2
MW6-GW1	E-5	NO	07-Feb-90	Groundwater Sample	M	Nickel	83.6		ug/L	40
MW6-GW1	E-5	NO	07-Feb-90	Groundwater Sample	M	Selenium	13	BW	ug/L	5
MW6-GW1	E-5	NO	07-Feb-90	Groundwater Sample	M	Silver	9.1	U	ug/L	10
MW6-GW1	E-5	NO	07-Feb-90	Groundwater Sample	M	Thallium	0.9	U	ug/L	10
MW6-GW1	E-5	NO	07-Feb-90	Groundwater Sample	M	Zinc	455		ug/L	20
MW6-GW1	E-5	YES	07-Feb-90	Groundwater Sample	M	Antimony	40.2	U	ug/L	60
MW6-GW1	E-5	YES	07-Feb-90	Groundwater Sample	M	Arsenic	1.5	U	ug/L	10
MW6-GW1	E-5	YES	07-Feb-90	Groundwater Sample	M	Beryllium	2.3	U	ug/L	5
MW6-GW1	E-5	YES	07-Feb-90	Groundwater Sample	M	Cadmium	1.9	U	ug/L	5
MW6-GW1	E-5	YES	07-Feb-90	Groundwater Sample	M	Chromium	8.7	U	ug/L	10
MW6-GW1	E-5	YES	07-Feb-90	Groundwater Sample	M	Copper	4.1	U	ug/L	25
MW6-GW1	E-5	YES	07-Feb-90	Groundwater Sample	M	Lead	3.1	J	ug/L	3
MW6-GW1	E-5	YES	07-Feb-90	Groundwater Sample	M	Mercury	0.1	U	ug/L	0.2
MW6-GW1	E-5	YES	07-Feb-90	Groundwater Sample	M	Nickel	23.6	U	ug/L	40
MW6-GW1	E-5	YES	07-Feb-90	Groundwater Sample	M	Selenium	1.7	U	ug/L	5
MW6-GW1	E-5	YES	07-Feb-90	Groundwater Sample	M	Silver	6.6	U	ug/L	10
MW6-GW1	E-5	YES	07-Feb-90	Groundwater Sample	M	Thallium	0.9	U	ug/L	10
MW6-GW1	E-5	YES	07-Feb-90	Groundwater Sample	M	Zinc	5	BJ	ug/L	20

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – GROUNDWATER

SAMPLE #	GRID #	YES/NO FILTERED	DATE	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUALIFIER	UNITS	DETECTION LIMIT
MW7-GW1	D-8	NO	07-Feb-90	Groundwater Sample	M	Antimony	34.6	U	ug/L	60
MW7-GW1	D-8	NO	07-Feb-90	Groundwater Sample	M	Arsenic	17.9		ug/L	10
MW7-GW1	D-8	NO	07-Feb-90	Groundwater Sample	M	Beryllium	3.8	U	ug/L	5
MW7-GW1	D-8	NO	07-Feb-90	Groundwater Sample	M	Cadmium	4.8	U	ug/L	5
MW7-GW1	D-8	NO	07-Feb-90	Groundwater Sample	M	Chromium	27		ug/L	10
MW7-GW1	D-8	NO	07-Feb-90	Groundwater Sample	M	Copper	31		ug/L	25
MW7-GW1	D-8	NO	07-Feb-90	Groundwater Sample	M	Lead	25.8	+	ug/L	3
MW7-GW1	D-8	NO	07-Feb-90	Groundwater Sample	M	Mercury	0.1	U	ug/L	0.2
MW7-GW1	D-8	NO	07-Feb-90	Groundwater Sample	M	Nickel	31.1	U	ug/L	40
MW7-GW1	D-8	NO	07-Feb-90	Groundwater Sample	M	Selenium	1.4	UW	ug/L	5
MW7-GW1	D-8	NO	07-Feb-90	Groundwater Sample	M	Silver	8.9	U	ug/L	10
MW7-GW1	D-8	NO	07-Feb-90	Groundwater Sample	M	Thallium	0.9	U	ug/L	10
MW7-GW1	D-8	NO	07-Feb-90	Groundwater Sample	M	Zinc	168		ug/L	20
MW7-GW1	D-8	YES	07-Feb-90	Groundwater Sample	M	Antimony	40.2	U	ug/L	60
MW7-GW1	D-8	YES	07-Feb-90	Groundwater Sample	M	Arsenic	6.9	B	ug/L	10
MW7-GW1	D-8	YES	07-Feb-90	Groundwater Sample	M	Beryllium	2.3	U	ug/L	5
MW7-GW1	D-8	YES	07-Feb-90	Groundwater Sample	M	Cadmium	1.9	U	ug/L	5
MW7-GW1	D-8	YES	07-Feb-90	Groundwater Sample	M	Chromium	8.7	U	ug/L	10
MW7-GW1	D-8	YES	07-Feb-90	Groundwater Sample	M	Copper	4.1	U	ug/L	25
MW7-GW1	D-8	YES	07-Feb-90	Groundwater Sample	M	Lead	4.9	J	ug/L	3
MW7-GW1	D-8	YES	07-Feb-90	Groundwater Sample	M	Mercury	0.1	U	ug/L	0.2
MW7-GW1	D-8	YES	07-Feb-90	Groundwater Sample	M	Nickel	23.6	U	ug/L	40
MW7-GW1	D-8	YES	07-Feb-90	Groundwater Sample	M	Selenium	1.7	U	ug/L	5
MW7-GW1	D-8	YES	07-Feb-90	Groundwater Sample	M	Silver	6.6	U	ug/L	10
MW7-GW1	D-8	YES	07-Feb-90	Groundwater Sample	M	Thallium	0.9	U	ug/L	10
MW7-GW1	D-8	YES	07-Feb-90	Groundwater Sample	M	Zinc	8	BJ	ug/L	20

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – GROUNDWATER

SAMPLE #	GRID #	YES/NO FILTERED	DATE	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUALIFIER	UNITS	DETECTION LIMIT
MW8-GW1	C-10	NO	07-Feb-90	Groundwater Sample	M	Antimony	40.2	U	ug/L	60
MW8-GW1	C-10	NO	07-Feb-90	Groundwater Sample	M	Arsenic	1.7	BW	ug/L	10
MW8-GW1	C-10	NO	07-Feb-90	Groundwater Sample	M	Beryllium	3	B	ug/L	5
MW8-GW1	C-10	NO	07-Feb-90	Groundwater Sample	M	Cadmium	1.9	U	ug/L	5
MW8-GW1	C-10	NO	07-Feb-90	Groundwater Sample	M	Chromium	65		ug/L	10
MW8-GW1	C-10	NO	07-Feb-90	Groundwater Sample	M	Copper	135		ug/L	25
MW8-GW1	C-10	NO	07-Feb-90	Groundwater Sample	M	Lead	58.1		ug/L	3
MW8-GW1	C-10	NO	07-Feb-90	Groundwater Sample	M	Mercury	0.1	U	ug/L	0.2
MW8-GW1	C-10	NO	07-Feb-90	Groundwater Sample	M	Nickel	134		ug/L	40
MW8-GW1	C-10	NO	07-Feb-90	Groundwater Sample	M	Selenium	1.7	UW	ug/L	5
MW8-GW1	C-10	NO	07-Feb-90	Groundwater Sample	M	Silver	6.6	U	ug/L	10
MW8-GW1	C-10	NO	07-Feb-90	Groundwater Sample	M	Thallium	0.9	U	ug/L	10
MW8-GW1	C-10	NO	07-Feb-90	Groundwater Sample	M	Zinc	642		ug/L	20
MW8-GW1	C-10	YES	07-Feb-90	Groundwater Sample	M	Antimony	34.6	U	ug/L	60
MW8-GW1	C-10	YES	07-Feb-90	Groundwater Sample	M	Arsenic	3.1	BW	ug/L	10
MW8-GW1	C-10	YES	07-Feb-90	Groundwater Sample	M	Beryllium	3.8	U	ug/L	5
MW8-GW1	C-10	YES	07-Feb-90	Groundwater Sample	M	Cadmium	4.8	U	ug/L	5
MW8-GW1	C-10	YES	07-Feb-90	Groundwater Sample	M	Chromium	9.8	U	ug/L	10
MW8-GW1	C-10	YES	07-Feb-90	Groundwater Sample	M	Copper	6	U	ug/L	25
MW8-GW1	C-10	YES	07-Feb-90	Groundwater Sample	M	Lead	6		ug/L	3
MW8-GW1	C-10	YES	07-Feb-90	Groundwater Sample	M	Mercury	0.1	U	ug/L	0.2
MW8-GW1	C-10	YES	07-Feb-90	Groundwater Sample	M	Nickel	31.1	U	ug/L	40
MW8-GW1	C-10	YES	07-Feb-90	Groundwater Sample	M	Selenium	1.4	U	ug/L	5
MW8-GW1	C-10	YES	07-Feb-90	Groundwater Sample	M	Silver	8.9	U	ug/L	10
MW8-GW1	C-10	YES	07-Feb-90	Groundwater Sample	M	Thallium	0.9	U	ug/L	10
MW8-GW1	C-10	YES	07-Feb-90	Groundwater Sample	M	Zinc	21	J	ug/L	20

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – GROUNDWATER

SAMPLE #	GRID #	YES/NO FILTERED	DATE	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUALIFIER	UNITS	DETECTION LIMIT
MW9-GW1	A-4	NO	16-Feb-90	Groundwater Sample	M	Antimony	40.2	U	ug/L	60
MW9-GW1	A-4	NO	16-Feb-90	Groundwater Sample	M	Arsenic	8.4	BS	ug/L	10
MW9-GW1	A-4	NO	16-Feb-90	Groundwater Sample	M	Beryllium	2.3	B	ug/L	5
MW9-GW1	A-4	NO	16-Feb-90	Groundwater Sample	M	Cadmium	1.9	U	ug/L	5
MW9-GW1	A-4	NO	16-Feb-90	Groundwater Sample	M	Chromium	24		ug/L	10
MW9-GW1	A-4	NO	16-Feb-90	Groundwater Sample	M	Copper	15	B	ug/L	25
MW9-GW1	A-4	NO	16-Feb-90	Groundwater Sample	M	Lead	33.3		ug/L	3
MW9-GW1	A-4	NO	16-Feb-90	Groundwater Sample	M	Mercury	0.1	U	ug/L	0.2
MW9-GW1	A-4	NO	16-Feb-90	Groundwater Sample	M	Nickel	23.6		ug/L	40
MW9-GW1	A-4	NO	16-Feb-90	Groundwater Sample	M	Selenium	1.7	UW	ug/L	5
MW9-GW1	A-4	NO	16-Feb-90	Groundwater Sample	M	Silver	6.6	U	ug/L	10
MW9-GW1	A-4	NO	16-Feb-90	Groundwater Sample	M	Thallium	0.9	U	ug/L	10
MW9-GW1	A-4	NO	16-Feb-90	Groundwater Sample	M	Zinc	62		ug/L	20
MW9-GW1	A-4	YES	16-Feb-90	Groundwater Sample	M	Antimony	40.2	U	ug/L	60
MW9-GW1	A-4	YES	16-Feb-90	Groundwater Sample	M	Arsenic	2	B	ug/L	10
MW9-GW1	A-4	YES	16-Feb-90	Groundwater Sample	M	Beryllium	2.3	U	ug/L	5
MW9-GW1	A-4	YES	16-Feb-90	Groundwater Sample	M	Cadmium	1.9	U	ug/L	5
MW9-GW1	A-4	YES	16-Feb-90	Groundwater Sample	M	Chromium	8.7	U	ug/L	10
MW9-GW1	A-4	YES	16-Feb-90	Groundwater Sample	M	Copper	4.1	U	ug/L	25
MW9-GW1	A-4	YES	16-Feb-90	Groundwater Sample	M	Lead	3.6	J	ug/L	3
MW9-GW1	A-4	YES	16-Feb-90	Groundwater Sample	M	Mercury	0.1	U	ug/L	0.2
MW9-GW1	A-4	YES	16-Feb-90	Groundwater Sample	M	Nickel	23.6	U	ug/L	40
MW9-GW1	A-4	YES	16-Feb-90	Groundwater Sample	M	Selenium	1.7	UW	ug/L	5
MW9-GW1	A-4	YES	16-Feb-90	Groundwater Sample	M	Silver	6.6	U	ug/L	10
MW9-GW1	A-4	YES	16-Feb-90	Groundwater Sample	M	Thallium	0.9	U	ug/L	10
MW9-GW1	A-4	YES	16-Feb-90	Groundwater Sample	M	Zinc	13	BJ	ug/L	20
MW1-GW2	C-6		06-Feb-90	Groundwater Sample	V	Acetone	100	UJ	ug/L	10
MW1-GW2	C-6		06-Feb-90	Groundwater Sample	V	2-Butanone	100	U	ug/L	10
MW1-GW2	C-6		06-Feb-90	Groundwater Sample	V	Vinyl Acetate	50	U	ug/L	10
MW1-GW2	C-6		06-Feb-90	Groundwater Sample	V	Benzene	560	D	ug/L	10
MW1-GW2	C-6		06-Feb-90	Groundwater Sample	V	2-Hexanone	50	U	ug/L	10
MW1-GW2	C-6		06-Feb-90	Groundwater Sample	V	4-Methyl-2-pentanone	50	U	ug/L	10
MW1-GW2	C-6		06-Feb-90	Groundwater Sample	V	Ethylbenzene	110		ug/L	10
MW1-GW2	C-6		06-Feb-90	Groundwater Sample	V	m/p-Xylene	35		ug/L	10
MW1-GW2	C-6		06-Feb-90	Groundwater Sample	V	o-Xylene	86		ug/L	10
MW2-GW2	B-7		07-Feb-90	Groundwater Sample	V	Acetone	100	U	ug/L	10
MW2-GW2	B-7		07-Feb-90	Groundwater Sample	V	2-Butanone	100	U	ug/L	10
MW2-GW2	B-7		07-Feb-90	Groundwater Sample	V	Vinyl Acetate	50	U	ug/L	10
MW2-GW2	B-7		07-Feb-90	Groundwater Sample	V	2-Hexanone	50	U	ug/L	10
[illegible]-GW2	B-7		07-Feb-90	Groundwater Sample	V	4-Methyl-2-pentanone	50	U	ug/L	10

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – GROUNDWATER

SAMPLE #	GRID #	YES/NO FILTERED	DATE	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUALIFIER	UNITS	DETECTION LIMIT
MW3-GW2	C-4		06-Feb-90	Groundwater Sample	V	Acetone	100	U	ug/L	10
MW3-GW2	C-4		06-Feb-90	Groundwater Sample	V	2-Butanone	100	U	ug/L	10
MW3-GW2	C-4		06-Feb-90	Groundwater Sample	V	Vinyl Acetate	50	U	ug/L	10
MW3-GW2	C-4		06-Feb-90	Groundwater Sample	V	Trichloroethene	7		ug/L	10
MW3-GW2	C-4		06-Feb-90	Groundwater Sample	V	2-Hexanone	50	U	ug/L	10
MW3-GW2	C-4		06-Feb-90	Groundwater Sample	V	4-Methyl-2-pentanone	50	U	ug/L	10
MW4-GW1	B-2		06-Feb-90	Groundwater Sample	V	Acetone	100	U	ug/L	10
MW4-GW1	B-2		06-Feb-90	Groundwater Sample	V	2-Butanone	100	U	ug/L	10
MW4-GW1	B-2		06-Feb-90	Groundwater Sample	V	Vinyl Acetate	50	U	ug/L	10
MW4-GW1	B-2		06-Feb-90	Groundwater Sample	V	2-Hexanone	50	U	ug/L	10
MW4-GW1	B-2		06-Feb-90	Groundwater Sample	V	4-Methyl-2-pentanone	50	U	ug/L	10
MW6-GW1	E-6		07-Feb-90	Groundwater Sample	V	Acetone	100	U	ug/L	10
MW6-GW1	E-6		07-Feb-90	Groundwater Sample	V	Trans-1,2-Dichloroethene	8		ug/L	10
MW6-GW1	E-6		07-Feb-90	Groundwater Sample	V	2-Butanone	100	U	ug/L	10
MW6-GW1	E-6		07-Feb-90	Groundwater Sample	V	Vinyl Acetate	50	U	ug/L	10
MW6-GW1	E-6		07-Feb-90	Groundwater Sample	V	Trichloroethene	78		ug/L	10
MW6-GW1	E-6		07-Feb-90	Groundwater Sample	V	2-Hexanone	50	U	ug/L	10
MW6-GW1	E-6		07-Feb-90	Groundwater Sample	V	4-Methyl-2-pentanone	50	U	ug/L	10

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – GROUNDWATER

SAMPLE #	GRID #	YES/NO FILTERED	DATE	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUALIFIER	UNITS	DETECTION LIMIT
MW7-GW1	D-7		07-Feb-90	Groundwater Sample	V	Chloromethane	100	U	ug/L	10
MW7-GW1	D-7		07-Feb-90	Groundwater Sample	V	Bromoethane	100	U	ug/L	10
MW7-GW1	D-7		07-Feb-90	Groundwater Sample	V	Vinyl Chloride	100	U	ug/L	10
MW7-GW1	D-7		07-Feb-90	Groundwater Sample	V	Chloroethane	100	U	ug/L	10
MW7-GW1	D-7		07-Feb-90	Groundwater Sample	V	Methylene_ Chloride	50	UJ	ug/L	10
MW7-GW1	D-7		07-Feb-90	Groundwater Sample	V	Acrolein	100	U	ug/L	10
MW7-GW1	D-7		07-Feb-90	Groundwater Sample	V	Acetone	1000	UJ	ug/L	10
MW7-GW1	D-7		07-Feb-90	Groundwater Sample	V	Arylonitrile	100	U	ug/L	10
MW7-GW1	D-7		07-Feb-90	Groundwater Sample	V	Carbon Disulfide	100	U	ug/L	10
MW7-GW1	D-7		07-Feb-90	Groundwater Sample	V	Trichlorofluoromethane	100	U	ug/L	10
MW7-GW1	D-7		07-Feb-90	Groundwater Sample	V	1,1-Dichloroethene	50	U	ug/L	10
MW7-GW1	D-7		07-Feb-90	Groundwater Sample	V	1,1-Dichloroethane	50	U	ug/L	10
MW7-GW1	D-7		07-Feb-90	Groundwater Sample	V	Trans-1,2-Dichloroethene	50	U	ug/L	10
MW7-GW1	D-7		07-Feb-90	Groundwater Sample	V	Chloroform	50	U	ug/L	10
MW7-GW1	D-7		07-Feb-90	Groundwater Sample	V	1,2-Dichloroethane	50	U	ug/L	10
MW7-GW1	D-7		07-Feb-90	Groundwater Sample	V	2-Butanone	100	U	ug/L	10
MW7-GW1	D-7		07-Feb-90	Groundwater Sample	V	1,1,1-Trichloroethane	50	U	ug/L	10
MW7-GW1	D-7		07-Feb-90	Groundwater Sample	V	Carbon Tetrachloride	50	U	ug/L	10
MW7-GW1	D-7		07-Feb-90	Groundwater Sample	V	Vinyl Acetate	500	U	ug/L	10
MW7-GW1	D-7		07-Feb-90	Groundwater Sample	V	Bromodichloromethane	50	U	ug/L	10
MW7-GW1	D-7		07-Feb-90	Groundwater Sample	V	1,2-Dichlorpropane	50	U	ug/L	10
MW7-GW1	D-7		07-Feb-90	Groundwater Sample	V	cis-1,3-Dichlorpropene	50	U	ug/L	10
MW7-GW1	D-7		07-Feb-90	Groundwater Sample	V	Trichloroethene	50	U	ug/L	10
MW7-GW1	D-7		07-Feb-90	Groundwater Sample	V	Benzene	200		ug/L	10
MW7-GW1	D-7		07-Feb-90	Groundwater Sample	V	Dibromochloromethane	50	U	ug/L	10
MW7-GW1	D-7		07-Feb-90	Groundwater Sample	V	1,1,2-Trichloroethane	50	U	ug/L	10
MW7-GW1	D-7		07-Feb-90	Groundwater Sample	V	trans-1,3-Dichlorpropene	50	U	ug/L	10
MW7-GW1	D-7		07-Feb-90	Groundwater Sample	V	2-ChloroethylVinylether	100	U	ug/L	10
MW7-GW1	D-7		07-Feb-90	Groundwater Sample	V	Bromoform	50	U	ug/L	10
MW7-GW1	D-7		07-Feb-90	Groundwater Sample	V	2-Hexanone	500	U	ug/L	10
MW7-GW1	D-7		07-Feb-90	Groundwater Sample	V	4-Methyl-2-pentanone	500	U	ug/L	10
MW7-GW1	D-7		07-Feb-90	Groundwater Sample	V	Tetrachloroethene	50	U	ug/L	10
MW7-GW1	D-7		07-Feb-90	Groundwater Sample	V	1,1,2,2-Tetrachloroethene	50	U	ug/L	10
MW7-GW1	D-7		07-Feb-90	Groundwater Sample	V	Toluene	50	U	ug/L	10
MW7-GW1	D-7		07-Feb-90	Groundwater Sample	V	Chlorobenzene	50	U	ug/L	10
MW7-GW1	D-7		07-Feb-90	Groundwater Sample	V	Ethylbenzene	90		ug/L	10
MW7-GW1	D-7		07-Feb-90	Groundwater Sample	V	Styrene	50	U	ug/L	10
MW7-GW1	D-7		07-Feb-90	Groundwater Sample	V	m/p-Xylene	21	J	ug/L	10
MW7-GW1	D-7		07-Feb-90	Groundwater Sample	V	o-Xylene	70		ug/L	10
MW7-GW1	D-7		07-Feb-90	Groundwater Sample	V	1,3-Dichlorobenzene	50	U	ug/L	10
[illegible]7-GW1	D-7		07-Feb-90	Groundwater Sample	V	1,2/1,4-Dichlorobenzene	50	U	ug/L	10

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – GROUNDWATER

SAMPLE #	GRID #	YES/NO FILTERED	DATE	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUALIFIER	UNITS	DETECTION LIMIT
MW8-GW1	C-10		07-Feb-90	Groundwater Sample	V	Methylene_Chloride	5	UJ	ug/L	10
MW8-GW1	C-10		07-Feb-90	Groundwater Sample	V	Acetone	100	U	ug/L	10
MW8-GW1	C-10		07-Feb-90	Groundwater Sample	V	2-Butanone	100	U	ug/L	10
MW8-GW1	C-10		07-Feb-90	Groundwater Sample	V	Vinyl Acetate	50	U	ug/L	10
MW8-GW1	C-10		07-Feb-90	Groundwater Sample	V	2-Hexanone	50	U	ug/L	10
MW8-GW1	C-10		07-Feb-90	Groundwater Sample	V	4-Methyl-2-pentanone	50	U	ug/L	10
MW9-GW1	A-4		16-Feb-90	Groundwater Sample	V	Acetone	100	U	ug/L	10
MW9-GW1	A-4		16-Feb-90	Groundwater Sample	V	2-Butanone	100	U	ug/L	10
MW9-GW1	A-4		16-Feb-90	Groundwater Sample	V	Vinyl Acetate	50	U	ug/L	10
MW9-GW1	A-4		16-Feb-90	Groundwater Sample	V	2-Hexanone	50	U	ug/L	10
MW9-GW1	A-4		16-Feb-90	Groundwater Sample	V	4-Methyl-2-pentanone	50	U	ug/L	10
D9			07-Feb-90	Groundwater Sample	V	Methylene_Chloride	5	UJ	ug/L	10
D9			07-Feb-90	Groundwater Sample	V	Acetone	100	U	ug/L	10
D9			07-Feb-90	Groundwater Sample	V	2-Butanone	100	U	ug/L	10
D9			07-Feb-90	Groundwater Sample	V	Vinyl Acetate	50	U	ug/L	10
D9			07-Feb-90	Groundwater Sample	V	2-Hexanone	50	U	ug/L	10
D9			07-Feb-90	Groundwater Sample	V	4-Methyl-2-pentanone	50	U	ug/L	10
MW1-GW2	C-6		06-Feb-90	Groundwater Sample	SV	3,3'-Dichlorobenzidine	20	U	ug/L	10
MW2-GW2	B-7		07-Feb-90	Groundwater Sample	SV	3,3'-Dichlorobenzidine	20	U	ug/L	10
MW3-GW2	C-4		06-Feb-90	Groundwater Sample	SV	ALL SEMI-VOLATILES	ND	J	ug/L	NA
MW4-GW1	B-2		06-Feb-90	Groundwater Sample	SV	3,3'-Dichlorobenzidine	20	U	ug/L	10
MW6-GW1	E-5		07-Feb-90	Groundwater Sample	SV	3,3'-Dichlorobenzidine	20	U	ug/L	10
MW7-GW1	D-7		07-Feb-90	Groundwater Sample	SV	3,3'-Dichlorobenzidine	20	U	ug/L	10
MW7-GW1	C-10		07-Feb-90	Groundwater Sample	SV	2-Methylnaphthalene	5	J	ug/L	10
MW7-GW1	C-10		07-Feb-90	Groundwater Sample	SV	3,3'-Dichlorobenzidine	20	U	ug/L	10
MW9-GW1	A-4		16-Feb-90	Groundwater Sample	SV	3,3'-Dichlorobenzidine	20	U	ug/L	10
D-9			07-Feb-90	Groundwater Sample	SV	2-Methylnaphthalene	5	J	ug/L	10
D-9			07-Feb-90	Groundwater Sample	SV	3,3'-Dichlorobenzidine	20	U	ug/L	10
D-9										
D-9	B-7		17-Oct-91	Groundwater Sample	SV	ALL SEMI-VOLATILES	ND	NA	ug/L	NA
MW-4	B-2		17-Oct-91	Groundwater Sample	SV	ALL SEMI-VOLATILES	ND	NA	ug/L	NA

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – GROUNDWATER

SAMPLE #	GRID #	YES/NO FILTERED	DATE	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUALIFIER	UNITS	DETECTION LIMIT
MW-6	E-5		17-Oct-91	Groundwater Sample	SV	ALL SEMI-VOLATILES	ND	NA	ug/L	NA
MW-7	D-7		17-Oct-91	Groundwater Sample	SV	Naphthalene	6	J	ug/L	
MW-7	D-7		17-Oct-91	Groundwater Sample	SV	2-Methylnaphthalene	2	J	ug/L	
MW-8	A-8		17-Oct-91	Groundwater Sample	SV	ALL SEMI-VOLATILES	ND	NA	ug/L	NA
MW-11	F-7		17-Oct-91	Groundwater Sample	SV	ALL SEMI-VOLATILES	ND	NA	ug/L	NA
MW-11DUP	F-7		17-Oct-91	Groundwater Sample	SV	ALL SEMI-VOLATILES	ND	NA	ug/L	NA
MW-12	E-9		17-Oct-91	Groundwater Sample	SV	ALL SEMI-VOLATILES	ND	NA	ug/L	NA
MW-2	B-7		17-Oct-91	Groundwater Sample	V	1,1,1-Trichloroethane	2	J	ug/L	
MW-3	C-4		17-Oct-91	Groundwater Sample	V	Trichloroethene	10		ug/L	
MW-3R	C-4		17-Oct-91	Groundwater Sample	V	Trichloroethene	8	J	ug/L	
MW-4	B-2		17-Oct-91	Groundwater Sample	V	ALL VOLATILES	ND	NA	ug/L	NA
MW-6	E-5		17-Oct-91	Groundwater Sample	V	1,2-Dichloroethene(total)	190		ug/L	
MW-6	E-5		17-Oct-91	Groundwater Sample	V	Trichloroethene	2000		ug/L	
MW-7	D-7		17-Oct-91	Groundwater Sample	V	Vinyl chloride	17		ug/L	
MW-7	D-7		17-Oct-91	Groundwater Sample	V	Benzene	19		ug/L	
MW-7	D-7		17-Oct-91	Groundwater Sample	V	Toluene	2	J	ug/L	
MW-7	D-7		17-Oct-91	Groundwater Sample	V	Ethylbenzene	62		ug/L	
MW-7	D-7		17-Oct-91	Groundwater Sample	V	Xylene (total)	36		ug/L	
MW-8	C-10		17-Oct-91	Groundwater Sample	V	1,1,1-Trichloroethane	3	J	ug/L	
MW-9	A-4		17-Oct-91	Groundwater Sample	V	ALL VOLATILES	ND	NA	ug/L	NA
MW-10	A-8		17-Oct-91	Groundwater Sample	V	ALL VOLATILES	ND	NA	ug/L	NA
MW-11	F-7		17-Oct-91	Groundwater Sample	V	ALL VOLATILES	ND	NA	ug/L	NA
MW-11DUP	F-7		17-Oct-91	Groundwater Sample	V	ALL VOLATILES	ND	NA	ug/L	NA
MW-12	E-9		17-Oct-91	Groundwater Sample	V	ALL VOLATILES	ND	NA	ug/L	NA

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – GROUNDWATER

SAMPLE #	GRID #	YES/NO FILTERED	DATE	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUALIFIER	UNITS	DETECTION LIMIT
MW-2	B-7	NO	17-Oct-91	Groundwater Sample	M	Antimony	28.2	J	ug/L	
MW-2	B-7	NO	17-Oct-91	Groundwater Sample	M	Arsenic	22.5	J	ug/L	
MW-2	B-7	NO	17-Oct-91	Groundwater Sample	M	Beryllium	5.1		ug/L	
MW-2	B-7	NO	17-Oct-91	Groundwater Sample	M	Cadmium	8		ug/L	
MW-2	B-7	NO	17-Oct-91	Groundwater Sample	M	Chromium	101	J	ug/L	
MW-2	B-7	NO	17-Oct-91	Groundwater Sample	M	Copper	347		ug/L	
MW-2	B-7	NO	17-Oct-91	Groundwater Sample	M	Lead	259		ug/L	
MW-2	B-7	NO	17-Oct-91	Groundwater Sample	M	Mercury	0.17		ug/L	
MW-2	B-7	NO	17-Oct-91	Groundwater Sample	M	Nickel	196		ug/L	
MW-2	B-7	NO	17-Oct-91	Groundwater Sample	M	Selenium	4	R	ug/L	
MW-2	B-7	NO	17-Oct-91	Groundwater Sample	M	Silver	3	U	ug/L	
MW-2	B-7	NO	17-Oct-91	Groundwater Sample	M	Thallium	4	R	ug/L	
MW-2	B-7	NO	17-Oct-91	Groundwater Sample	M	Zinc	1090		ug/L	
MW-2	B-7	YES	17-Oct-91	Groundwater Sample	M	Antimony	9	U	ug/L	
MW-2	B-7	YES	17-Oct-91	Groundwater Sample	M	Arsenic	5.1		ug/L	
MW-2	B-7	YES	17-Oct-91	Groundwater Sample	M	Beryllium	1	U	ug/L	
MW-2	B-7	YES	17-Oct-91	Groundwater Sample	M	Cadmium	2	U	ug/L	
MW-2	B-7	YES	17-Oct-91	Groundwater Sample	M	Chromium	3	U	ug/L	
MW-2	B-7	YES	17-Oct-91	Groundwater Sample	M	Copper	3.1	J	ug/L	
MW-2	B-7	YES	17-Oct-91	Groundwater Sample	M	Lead	7.7	J	ug/L	
MW-2	B-7	YES	17-Oct-91	Groundwater Sample	M	Mercury	0.1	U	ug/L	
MW-2	B-7	YES	17-Oct-91	Groundwater Sample	M	Nickel	9	U	ug/L	
MW-2	B-7	YES	17-Oct-91	Groundwater Sample	M	Selenium	2.2	UJ	ug/L	
MW-2	B-7	YES	17-Oct-91	Groundwater Sample	M	Silver	3	U	ug/L	
MW-2	B-7	YES	17-Oct-91	Groundwater Sample	M	Thallium	2.2	U	ug/L	
MW-2	B-7	YES	17-Oct-91	Groundwater Sample	M	Zinc	4.7	J	ug/L	

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – GROUNDWATER

SAMPLE #	GRID #	YES/NO FILTERED	DATE	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUALIFIER	UNITS	DETECTION LIMIT
MW-4	B-2	NO	17-Oct-91	Groundwater Sample	M	Antimony	29.5	J	ug/L	
MW-4	B-2	NO	17-Oct-91	Groundwater Sample	M	Arsenic	6.9	J	ug/L	
MW-4	B-2	NO	17-Oct-91	Groundwater Sample	M	Beryllium	3.7		ug/L	
MW-4	B-2	NO	17-Oct-91	Groundwater Sample	M	Cadmium	4.6		ug/L	
MW-4	B-2	NO	17-Oct-91	Groundwater Sample	M	Chromium	96.7	J	ug/L	
MW-4	B-2	NO	17-Oct-91	Groundwater Sample	M	Copper	208		ug/L	
MW-4	B-2	NO	17-Oct-91	Groundwater Sample	M	Lead	109		ug/L	
MW-4	B-2	NO	17-Oct-91	Groundwater Sample	M	Mercury	0.29		ug/L	
MW-4	B-2	NO	17-Oct-91	Groundwater Sample	M	Nickel	202		ug/L	
MW-4	B-2	NO	17-Oct-91	Groundwater Sample	M	Selenium	8	R	ug/L	
MW-4	B-2	NO	17-Oct-91	Groundwater Sample	M	Silver	3	U	ug/L	
MW-4	B-2	NO	17-Oct-91	Groundwater Sample	M	Thallium	4	R	ug/L	
MW-4	B-2	NO	17-Oct-91	Groundwater Sample	M	Zinc	645		ug/L	
MW-4	B-2	YES	17-Oct-91	Groundwater Sample	M	Antimony	9	U	ug/L	
MW-4	B-2	YES	17-Oct-91	Groundwater Sample	M	Arsenic	2		ug/L	
MW-4	B-2	YES	17-Oct-91	Groundwater Sample	M	Beryllium	1	U	ug/L	
MW-4	B-2	YES	17-Oct-91	Groundwater Sample	M	Cadmium	2	U	ug/L	
MW-4	B-2	YES	17-Oct-91	Groundwater Sample	M	Chromium	3	U	ug/L	
MW-4	B-2	YES	17-Oct-91	Groundwater Sample	M	Copper	3	U	ug/L	
MW-4	B-2	YES	17-Oct-91	Groundwater Sample	M	Lead	1.9	J	ug/L	
MW-4	B-2	YES	17-Oct-91	Groundwater Sample	M	Mercury	0.1	U	ug/L	
MW-4	B-2	YES	17-Oct-91	Groundwater Sample	M	Nickel	9	U	ug/L	
MW-4	B-2	YES	17-Oct-91	Groundwater Sample	M	Selenium	2.2	UJ	ug/L	
MW-4	B-2	YES	17-Oct-91	Groundwater Sample	M	Silver	3	U	ug/L	
MW-4	B-2	YES	17-Oct-91	Groundwater Sample	M	Thallium	2.2	U	ug/L	
MW-4	B-2	YES	17-Oct-91	Groundwater Sample	M	Zinc	3	J	ug/L	

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – GROUNDWATER

SAMPLE #	GRID #	YES/NO FILTERED	DATE	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUALIFIER	UNITS	DETECTION LIMIT
MW-6	E-5	NO	17-Oct-91	Groundwater Sample	M	Antimony	24.8	J	ug/L	
MW-6	E-5	NO	17-Oct-91	Groundwater Sample	M	Arsenic	2	J	ug/L	
MW-6	E-5	NO	17-Oct-91	Groundwater Sample	M	Beryllium	12.1		ug/L	
MW-6	E-5	NO	17-Oct-91	Groundwater Sample	M	Cadmium	18.9		ug/L	
MW-6	E-5	NO	17-Oct-91	Groundwater Sample	M	Chromium	247		ug/L	
MW-6	E-5	NO	17-Oct-91	Groundwater Sample	M	Copper	868		ug/L	
MW-6	E-5	NO	17-Oct-91	Groundwater Sample	M	Lead	647		ug/L	
MW-6	E-5	NO	17-Oct-91	Groundwater Sample	M	Mercury	0.55		ug/L	
MW-6	E-5	NO	17-Oct-91	Groundwater Sample	M	Nickel	730		ug/L	
MW-6	E-5	NO	17-Oct-91	Groundwater Sample	M	Selenium	8	R	ug/L	
MW-6	E-5	NO	17-Oct-91	Groundwater Sample	M	Silver	3	U	ug/L	
MW-6	E-5	NO	17-Oct-91	Groundwater Sample	M	Thallium	4	R	ug/L	
MW-6	E-5	NO	17-Oct-91	Groundwater Sample	M	Zinc	3260		ug/L	
MW-6	E-5	YES	17-Oct-91	Groundwater Sample	M	Antimony	9	U	ug/L	
MW-6	E-5	YES	17-Oct-91	Groundwater Sample	M	Arsenic	2	U	ug/L	
MW-6	E-5	YES	17-Oct-91	Groundwater Sample	M	Beryllium	1	U	ug/L	
MW-6	E-5	YES	17-Oct-91	Groundwater Sample	M	Cadmium	2	U	ug/L	
MW-6	E-5	YES	17-Oct-91	Groundwater Sample	M	Chromium	3	U	ug/L	
MW-6	E-5	YES	17-Oct-91	Groundwater Sample	M	Copper	6.2	J	ug/L	
MW-6	E-5	YES	17-Oct-91	Groundwater Sample	M	Lead	2	J	ug/L	
MW-6	E-5	YES	17-Oct-91	Groundwater Sample	M	Mercury	0.1	U	ug/L	
MW-6	E-5	YES	17-Oct-91	Groundwater Sample	M	Nickel	9	U	ug/L	
MW-6	E-5	YES	17-Oct-91	Groundwater Sample	M	Selenium	2.2	UJ	ug/L	
MW-6	E-5	YES	17-Oct-91	Groundwater Sample	M	Silver	3	U	ug/L	
MW-6	E-5	YES	17-Oct-91	Groundwater Sample	M	Thallium	2.2	U	ug/L	
MW-6	E-5	YES	17-Oct-91	Groundwater Sample	M	Zinc	20.1		ug/L	

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – GROUNDWATER

SAMPLE #	GRID #	YES/NO FILTERED	DATE	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUALIFIER	UNITS	DETECTION LIMIT
MW-7	D-7	NO	17-Oct-91	Groundwater Sample	M	Antimony	18.9	J	ug/L	
MW-7	D-7	NO	17-Oct-91	Groundwater Sample	M	Arsenic	4.5	J	ug/L	
MW-7	D-7	NO	17-Oct-91	Groundwater Sample	M	Beryllium	3		ug/L	
MW-7	D-7	NO	17-Oct-91	Groundwater Sample	M	Cadmium	2.8		ug/L	
MW-7	D-7	NO	17-Oct-91	Groundwater Sample	M	Chromium	66.4		ug/L	
MW-7	D-7	NO	17-Oct-91	Groundwater Sample	M	Copper	155		ug/L	
MW-7	D-7	NO	17-Oct-91	Groundwater Sample	M	Lead	147		ug/L	
MW-7	D-7	NO	17-Oct-91	Groundwater Sample	M	Mercury	0.1	U	ug/L	
MW-7	D-7	NO	17-Oct-91	Groundwater Sample	M	Nickel	152		ug/L	
MW-7	D-7	NO	17-Oct-91	Groundwater Sample	M	Selenium	8	R	ug/L	
MW-7	D-7	NO	17-Oct-91	Groundwater Sample	M	Silver	3	U	ug/L	
MW-7	D-7	NO	17-Oct-91	Groundwater Sample	M	Thallium	4	R	ug/L	
MW-7	D-7	NO	17-Oct-91	Groundwater Sample	M	Zinc	513		ug/L	
MW-7	D-7	YES	17-Oct-91	Groundwater Sample	M	Antimony	9	U	ug/L	
MW-7	D-7	YES	17-Oct-91	Groundwater Sample	M	Arsenic	7.6		ug/L	
MW-7	D-7	YES	17-Oct-91	Groundwater Sample	M	Beryllium	1	U	ug/L	
MW-7	D-7	YES	17-Oct-91	Groundwater Sample	M	Cadmium	2	U	ug/L	
MW-7	D-7	YES	17-Oct-91	Groundwater Sample	M	Chromium	3	U	ug/L	
MW-7	D-7	YES	17-Oct-91	Groundwater Sample	M	Copper	3	U	ug/L	
MW-7	D-7	YES	17-Oct-91	Groundwater Sample	M	Lead	3.8	J	ug/L	
MW-7	D-7	YES	17-Oct-91	Groundwater Sample	M	Mercury	0.1	U	ug/L	
MW-7	D-7	YES	17-Oct-91	Groundwater Sample	M	Nickel	9	U	ug/L	
MW-7	D-7	YES	17-Oct-91	Groundwater Sample	M	Selenium	2.2	UJ	ug/L	
MW-7	D-7	YES	17-Oct-91	Groundwater Sample	M	Silver	3	U	ug/L	
MW-7	D-7	YES	17-Oct-91	Groundwater Sample	M	Thallium	2.2	U	ug/L	
MW-7	D-7	YES	17-Oct-91	Groundwater Sample	M	Zinc	4.7	J	ug/L	

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – GROUNDWATER

SAMPLE #	GRID #	YES/NO FILTERED	DATE	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUALIFIER	UNITS	DETECTION LIMIT
MW-10	A-8	NO	17-Oct-91	Groundwater Sample	M	Antimony	28.7	J	ug/L	
MW-10	A-8	NO	17-Oct-91	Groundwater Sample	M	Arsenic	58.9	J	ug/L	
MW-10	A-8	NO	17-Oct-91	Groundwater Sample	M	Beryllium	4.5		ug/L	
MW-10	A-8	NO	17-Oct-91	Groundwater Sample	M	Cadmium	6		ug/L	
MW-10	A-8	NO	17-Oct-91	Groundwater Sample	M	Chromium	96.5		ug/L	
MW-10	A-8	NO	17-Oct-91	Groundwater Sample	M	Copper	175		ug/L	
MW-10	A-8	NO	17-Oct-91	Groundwater Sample	M	Lead	132		ug/L	
MW-10	A-8	NO	17-Oct-91	Groundwater Sample	M	Mercury	0.1	U	ug/L	
MW-10	A-8	NO	17-Oct-91	Groundwater Sample	M	Nickel	169		ug/L	
MW-10	A-8	NO	17-Oct-91	Groundwater Sample	M	Selenium	8	R	ug/L	
MW-10	A-8	NO	17-Oct-91	Groundwater Sample	M	Silver	3	U	ug/L	
MW-10	A-8	NO	17-Oct-91	Groundwater Sample	M	Thallium	4	R	ug/L	
MW-10	A-8	NO	17-Oct-91	Groundwater Sample	M	Zinc	550		ug/L	
MW-10	A-8	YES	17-Oct-91	Groundwater Sample	M	Antimony	9	U	ug/L	
MW-10	A-8	YES	17-Oct-91	Groundwater Sample	M	Arsenic	12.1		ug/L	
MW-10	A-8	YES	17-Oct-91	Groundwater Sample	M	Beryllium	1	U	ug/L	
MW-10	A-8	YES	17-Oct-91	Groundwater Sample	M	Cadmium	2	U	ug/L	
MW-10	A-8	YES	17-Oct-91	Groundwater Sample	M	Chromium	3	U	ug/L	
MW-10	A-8	YES	17-Oct-91	Groundwater Sample	M	Copper	3	U	ug/L	
MW-10	A-8	YES	17-Oct-91	Groundwater Sample	M	Lead	2.7	J	ug/L	
MW-10	A-8	YES	17-Oct-91	Groundwater Sample	M	Mercury	0.1	U	ug/L	
MW-10	A-8	YES	17-Oct-91	Groundwater Sample	M	Nickel	9	U	ug/L	
MW-10	A-8	YES	17-Oct-91	Groundwater Sample	M	Selenium	2.2	UJ	ug/L	
MW-10	A-8	YES	17-Oct-91	Groundwater Sample	M	Silver	3	U	ug/L	
MW-10	A-8	YES	17-Oct-91	Groundwater Sample	M	Thallium	2.2	U	ug/L	
MW-10	A-8	YES	17-Oct-91	Groundwater Sample	M	Zinc	3.7	J	ug/L	

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – GROUNDWATER

SAMPLE #	GRID #	YES/NO FILTERED	DATE	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUALIFIER	UNITS	DETECTION LIMIT
MW-11	F-7	NO	17-Oct-91	Groundwater Sample	M	Antimony	65.4	J	ug/L	
MW-11	F-7	NO	17-Oct-91	Groundwater Sample	M	Arsenic	45.9	J	ug/L	
MW-11	F-7	NO	17-Oct-91	Groundwater Sample	M	Beryllium	6.2		ug/L	
MW-11	F-7	NO	17-Oct-91	Groundwater Sample	M	Cadmium	8.7		ug/L	
MW-11	F-7	NO	17-Oct-91	Groundwater Sample	M	Chromium	149	J	ug/L	
MW-11	F-7	NO	17-Oct-91	Groundwater Sample	M	Copper	322		ug/L	
MW-11	F-7	NO	17-Oct-91	Groundwater Sample	M	Lead	225		ug/L	
MW-11	F-7	NO	17-Oct-91	Groundwater Sample	M	Mercury	0.14		ug/L	
MW-11	F-7	NO	17-Oct-91	Groundwater Sample	M	Nickel	278		ug/L	
MW-11	F-7	NO	17-Oct-91	Groundwater Sample	M	Selenium	8	R	ug/L	
MW-11	F-7	NO	17-Oct-91	Groundwater Sample	M	Silver	9		ug/L	
MW-11	F-7	NO	17-Oct-91	Groundwater Sample	M	Thallium	4	R	ug/L	
MW-11	F-7	NO	17-Oct-91	Groundwater Sample	M	Zinc	1090		ug/L	
MW-11	F-7	YES	17-Oct-91	Groundwater Sample	M	Antimony	9	U	ug/L	
MW-11	F-7	YES	17-Oct-91	Groundwater Sample	M	Arsenic	4.1	J	ug/L	
MW-11	F-7	YES	17-Oct-91	Groundwater Sample	M	Beryllium	1	U	ug/L	
MW-11	F-7	YES	17-Oct-91	Groundwater Sample	M	Cadmium	2	U	ug/L	
MW-11	F-7	YES	17-Oct-91	Groundwater Sample	M	Chromium	3	U	ug/L	
MW-11	F-7	YES	17-Oct-91	Groundwater Sample	M	Copper	3	U	ug/L	
MW-11	F-7	YES	17-Oct-91	Groundwater Sample	M	Lead	2.2	J	ug/L	
MW-11	F-7	YES	17-Oct-91	Groundwater Sample	M	Mercury	0.1	U	ug/L	
MW-11	F-7	YES	17-Oct-91	Groundwater Sample	M	Nickel	9	U	ug/L	
MW-11	F-7	YES	17-Oct-91	Groundwater Sample	M	Selenium	2.2	UJ	ug/L	
MW-11	F-7	YES	17-Oct-91	Groundwater Sample	M	Silver	3	U	ug/L	
MW-11	F-7	YES	17-Oct-91	Groundwater Sample	M	Thallium	2.2	U	ug/L	
MW-11	F-7	YES	17-Oct-91	Groundwater Sample	M	Zinc	3	U	ug/L	

RICKENBACKER ANGB HAZARDOUS WASTE STORAGE AREA
ANALYTICAL RESULTS – GROUNDWATER

SAMPLE #	GRID #	YES/NO FILTERED	DATE	DESCRIPTION	CATEGORY	ANALYSIS FOR	RESULTS	QUALIFIER	UNITS	DETECTION LIMIT
MW-12	E-9	NO	17-Oct-91	Groundwater Sample	M	Antimony	33.9	J	ug/L	
MW-12	E-9	NO	17-Oct-91	Groundwater Sample	M	Arsenic	12.9	J	ug/L	
MW-12	E-9	NO	17-Oct-91	Groundwater Sample	M	Beryllium	4.9		ug/L	
MW-12	E-9	NO	17-Oct-91	Groundwater Sample	M	Cadmium	6.5		ug/L	
MW-12	E-9	NO	17-Oct-91	Groundwater Sample	M	Chromium	97.1	J	ug/L	
MW-12	E-9	NO	17-Oct-91	Groundwater Sample	M	Copper	328		ug/L	
MW-12	E-9	NO	17-Oct-91	Groundwater Sample	M	Lead	185		ug/L	
MW-12	E-9	NO	17-Oct-91	Groundwater Sample	M	Mercury	0.18		ug/L	
MW-12	E-9	NO	17-Oct-91	Groundwater Sample	M	Nickel	178		ug/L	
MW-12	E-9	NO	17-Oct-91	Groundwater Sample	M	Selenium	8	R	ug/L	
MW-12	E-9	NO	17-Oct-91	Groundwater Sample	M	Silver	3	U	ug/L	
MW-12	E-9	NO	17-Oct-91	Groundwater Sample	M	Thallium	4	R	ug/L	
MW-12	E-9	NO	17-Oct-91	Groundwater Sample	M	Zinc	898		ug/L	
MW-12	E-9	YES	17-Oct-91	Groundwater Sample	M	Antimony	9	U	ug/L	
MW-12	E-9	YES	17-Oct-91	Groundwater Sample	M	Arsenic	3.6	J	ug/L	
MW-12	E-9	YES	17-Oct-91	Groundwater Sample	M	Beryllium	1	U	ug/L	
MW-12	E-9	YES	17-Oct-91	Groundwater Sample	M	Cadmium	2	U	ug/L	
MW-12	E-9	YES	17-Oct-91	Groundwater Sample	M	Chromium	3	U	ug/L	
MW-12	E-9	YES	17-Oct-91	Groundwater Sample	M	Copper	3.9	J	ug/L	
MW-12	E-9	YES	17-Oct-91	Groundwater Sample	M	Lead	2.4	J	ug/L	
MW-12	E-9	YES	17-Oct-91	Groundwater Sample	M	Mercury	0.1	U	ug/L	
MW-12	E-9	YES	17-Oct-91	Groundwater Sample	M	Nickel	9	U	ug/L	
MW-12	E-9	YES	17-Oct-91	Groundwater Sample	M	Selenium	2.2	UJ	ug/L	
MW-12	E-9	YES	17-Oct-91	Groundwater Sample	M	Silver	3	U	ug/L	
MW-12	E-9	YES	17-Oct-91	Groundwater Sample	M	Thallium	2.2	U	ug/L	
MW-12	E-9	YES	17-Oct-91	Groundwater Sample	M	Zinc	6.2	J	ug/L	

TABLE A.1

SOLUBILITY CONSTANTS
HAZARDOUS WASTE STORAGE AREA
RICKENBACKER AIR NATIONAL GUARD BASE

Compound	Water Solubility (1)
Acetone	1000000 mg/L (2)
Benzene	1750 mg/L
Carbon Tetrachloride	757 mg/L
Chloroethane	N/A (3)
Chloroform	82000 mg/L
Creosol	31000 mg/L
1,1–Dichloroethane	280 mg/L
1,2–Dichloroethane	5500 mg/L
cis–1,2–Dichloroethene	3500 mg/L
trans–1,2–Dichloroethene	6300 mg/L
Ethylbenzene	152 mg/L
Dichloromethane	4600 mg/L
2–Butanone	268000 mg/L
Phenol	93000 mg/L
1,1,1,2–Tetrachloroethane	2900 mg/L
1,1,2,2–Tetrachloroethane	2900 mg/L
Tetrachloroethene	150 mg/L
Methylchloroform	N/A
1,1,2–Trichloroethane	4500 mg/L
Trichloroethene	1100 mg/L
Vinyl Chloride	2670 mg/L
Xylenes	198 mg/L

(1) Source– Superfund Public Health Evaluation Manual, EPA/540/1–86/060, October 1986.
(2) mg/L– milligrams per liter
(3) Not available.

REVISED MARCH 1993

APPENDIX B

SUMMARY OF PREVIOUS INVESTIGATIONS, INCLUDING 1991 ANALYTICAL DATA

APPENDIX B

PREVIOUS INVESTIGATIONS

1.0 1988 FIELD INVESTIGATION

Engineering-Science (ES) completed the first phase of the field investigation at the Hazardous Waste Storage Area (HWSA) in October 1988. The purpose of the investigation was to determine if the soil or groundwater beneath the site had been contaminated due to spills or leaks form on-site storage containers.

The results of this investigation are presented in detail in the Field Investigation Report - Hazardous Waste Storage Area: Rickenbacker Air National Guard Base, Columbus, Ohio (1989), and the results are summarized in the following paragraphs.

1.1 SUMMARY OF ANALYTICAL RESULTS

The soil-gas survey identified with elevated concentrations of benzene, toluene and ortho-xylene (BTX). Concentration of total BTX in the soil gas ranged from undetectable to 29.8 ppm.

Analyses of the soil samples indicated elevated semi-volatile organic and metals concentrations. The characteristics of the semi-volatile organics found were typical of coal-tar derivatives and phthalates. Metals identified included cadmium, chromium, copper, lead and zinc.

Three of the auger borings made during soil sampling were completed as monitoring wells in the shallow aquifer. Water samples from two of these wells exhibited volatile organic concentrations in excess of Federal Maximum Contaminant Levels (MCLs). Water from MW1 contained 94 μg/l benzene, 20 μg/l xylenes and 13 μg/l methylnapthalene. Water from MW3 contained 44 μg/l trichloroethene. Samples from all wells had total unfiltered metals concentrations in excess of Federal Drinking Water Standards for arsenic, cadmium, chromium and lead.

2.0 1990 FIELD INVESTIGATION

The phase of the field investigation at the HWSA was completed in March 1990. The purpose of this additional field investigation was to determine the extent of contamination and to allow revision of the Closure Plan to affect a "clean" closure of the site.

The pre-closure sampling activities included soil sampling at the surface and at depth and the installation of six new monitoring wells in and around the HWSA (MW4 through MW9). The results of this investigation are presented in detail in the Pre-Closure Sampling Report - Hazardous Waste Storage Area: Rickenbacker Air National Guard Base. Columbus, Ohio (1992), and a summary of the results follows.

2.1 SUMMARY OF ANALYTICAL RESULTS

2.6.1 Metals

Total metals were found over the site with higher levels within the fenced area. Detected above background criteria were beryllium, cadmium, copper, lead, mercury, silver and zinc.

2.2 VOLATILE ORGANIC COMPOUNDS

Volatile organic compounds in samples from the 0-2 foot interval, were only analyzed for at six hand boring and two monitoring well locations. The only VOCs detected were 440,000 μg/kg o-xylene at HB1.

Volatile organic compounds were detected at concentrations up to 1,900,000 μg/kg in soils from the 3-5 foot interval. Elevated ethylbenzene and o-xylene concentrations were found in HB1, near Building 560, while benzene was detected in AB2.

Volatile organics were found in samples from the 8-10 foot interval at levels up to 27,000 μg/kg of o-xylene. The highest concentrations were found at AB1, AB14 and MW7. Specific compounds include: benzene, ethylbenzene, xylenes and 1,1,1-trichloroethane.

Samples from the 13-15 foot interval containing volatile organic compounds were found in the southern corner and along the northeast side of the area. These include:

benzene, ethylbenzene, toluene, xylenes, acetone, trichloroethene, trans-1,2-dichloroethene, 1,1-dichloroethene, and vinyl chloride. The highest concentration was 1,000 μg/kg trans-1,2-dichloroethene at MW6.

At the greater than fifteen foot interval, sand and gravel is present to a depth of approximately 25' with a thin layer of clay from 18'-19'. Detected volatile and semi-volatile organics were confined to the southeast side of the area. Semi-volatile organics were found only at MW1 at a total concentration of 1,830 μg/kg. The highest volatile organic concentrations were also found at this location. They were benzene, ethylbenzene, and o-xylene at concentrations of 1,900, 11,000, and 20,000 μg/kg, respectively.

2.3 SEMI-VOLATILE ORGANIC COMPOUNDS

Semi-volatile organics were detected in the soils at various depths and ranged from non-detect to 4,630 μg/kg.

2.6.2 Groundwater

Volatile and Semi-Volatile Organics

On the analytical results map (Sheet 6), both the 1990 and 1988 sampling data are shown. The only semi-volatile organic compound found in the groundwater was 2-methylnaphthalene at 5J μg/L in MW8.

Volatile organics compounds were detected in MW1, MW3, MW6 and MW7, and include benzene, ethylbenzene, o-xylene, p-xylene, trichloroethene, and trans-1,2-dichloroethene. In addition, four feet of phase-separated hydrocarbons were floating in MW5. Fingerprint analysis of the liquid hydrocarbons identified it as a 30 to 40 percent weathered gasoline mixed with jet fuel.

Filtered Metals

Four metals were detected at all concentrations below the Federal Drinking Water Standards. These four metals were arsenic (found at 2.0 to 9.4 μg/L), lead (found at 3.1 to 14.0 μg/L), zinc (found at 5.0 to 35 μg/L) and mercury (found at 0.11 μg/L).

3.0 1991 FIELD INVESTIGATION

The third phase of the field investigation at the HWSA was completed in October 1991. Field activities conducted during this investigation include groundwater screening, monitoring well installation and soil sampling from the well borings, surface soil sampling, and groundwater sampling.

The additional sampling was conducted to fill data gaps existing after the original pre-closure sampling report. Specifically, these data gaps are:

- The anomalously high concentrations of semi-volatile organic compounds (SVOCs) found at the surface soils of the westernmost corner of the HWSA.

- The extent of VOCs previously detected in the groundwater.

The results of this investigation were reported in the Addendum to the Pre-Closure Sampling Report - Hazardous Waste Storage Area: Rickenbacker Air National Guard Base, Columbus, Ohio (1992) and a summary of the results follows.

The data obtained through the groundwater sampling indicate that petroleum hydrocarbon and chlorinated organic contamination is restricted to the area upgradient and downgradient of the four underground storage tanks (USTs) numbered 47, 48, 49, 50. Wells MW1 and MW5, where phase-separated hydrocarbons were observed, lie in the northern and furthest upgradient portion of this contaminant plume. In the downgradient direction, the dissolved organic plume does not extend to MW11 and MW12.

Volatile organic results of the groundwater sampling events indicate that chlorinated organics are present in MW3 and MW6. The compound 1,1,1-trichloroethane was found at an estimated concentration of 3 $\mu g/L$ in MW8 during the 1991 sampling event. This compound was also found in MW2 at an estimated quantity of 2 $\mu g/L$. Although this compound was found in the associated trip blank, it is still possible that it is present at this site since it has been detected in the past.

No groundwater samples were collected from MW5 in either sampling event due to the presence of PSH. In 1990, MW1 had concentrations of dissolved benzene, ethylbenzene and xylenes; however, due to the presence of PSH in 1991, this well was

not resampled. Dissolved benzene, ethylbenzene and xylenes were found in MW7. No volatile organics were detected in MW4 and MW9.

The semi-volatile organic compounds, 2-methylnaphthalene and naphthalene were found in MW7 at estimated concentrations 2 and 6 $\mu g/L$ respectively.

Groundwater analyses indicate the presence of total metals in the water samples; however, the filtered aliquot analysis showed a decrease in metals concentrations. Therefore, the presence of metals is associated with the silt suspended in the water sample.

Four metals were detected in filtered groundwater samples, all at concentrations below the Federal Drinking Water Standards. These four metals were arsenic found at 2.9 to 12.1 $\mu g/L$, copper at 3.1 to 6.2 $\mu g/L$, lead at 1.9 to 7.7 $\mu g/L$, and zinc at 3.7 to 20.1 $\mu g/L$.

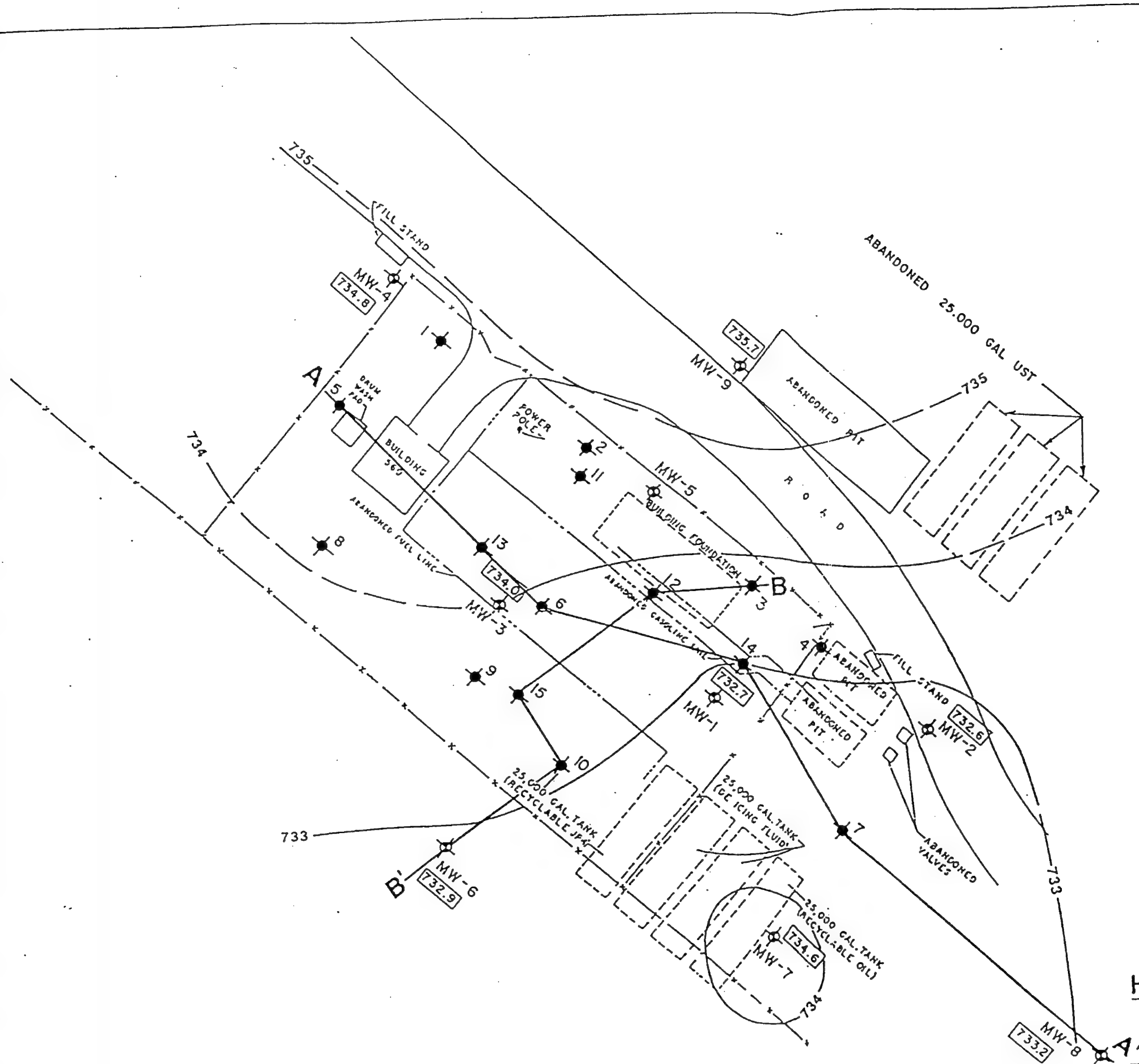
Soil Results

Five of the ten surface soil samples were collected at the fenceline surrounding the site, the remaining five from locations off site. One sample (SS3) was collected in duplicate. All surface soil samples were analyzed for SVOCs and the priority pollutant metals.

Samples with no detected SVOCs are SS1, SS2 and SS7. Samples SS3, SS9 and SS10 have the highest total SVOC concentrations, 1108, 2250 and 977 $\mu g/kg$ respectively. The SVOCs detected can be classified as coal tar derivatives.

Metals analysis from these surface soil samples were compared to background levels that were established for the Base during the Site Investigation for the Installation Restoration Program. Detected above background criteria were arsenic, cadmium, copper, lead, nickel, silver and zinc.

Soil boring samples were collected from two depths (3 to 5 feet and 13 to 15 feet) in each of the three soil borings. Each sample was analyzed for SVOCs, VOCs, and priority pollutant metals. SVOCs were not detected in either of the two samples from MW10 and MW11. The soil sample from the 13 to 15 foot horizon of MW12 had a total semi-volatile concentration of 1569 $\mu g/kg$ although no SVOCs were detected in the shallow soil sample (3 to 5 feet), or in the groundwater sample from this well. These compounds are coal tar derivatives.



30 15 0 30 60

FEET

LEGEND :

1 RB-HW-AB1
2 RB-HW-AB2
3 RB-HW-AB3
4 RB-HW-AB4
5 RB-HW-AB5
6 RB-HW-AB6
7 RB-HW-AB7
8 RB-HW-AB8
9 RB-HW-AB9
10 RB-HW-AB10
11 RB-HW-AB11
12 RB-HW-AB12
13 RB-HW-AB13
14 RB-HW-AB14
15 RB-HW-AB15

FIGURE B.3

CROSS-SECTION LOCATION AND WATER SURFACE MAP HAZARDOUS WASTE STORAGE AREA RICKENBACKER ANGB, OHIO

6 FEBRUARY 1990

ES ENGINEERING—SCIENCE

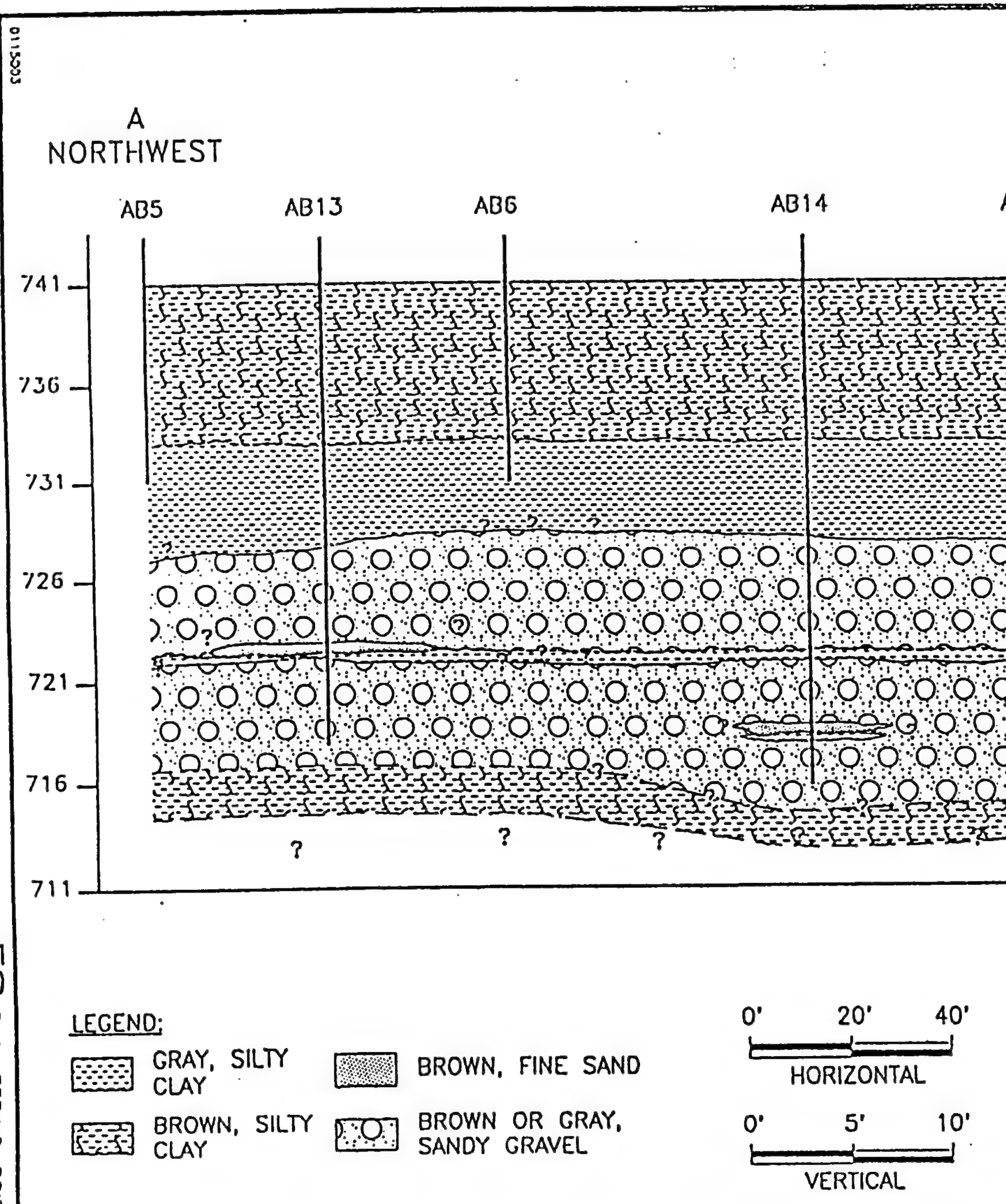


FIGURE B.1

HAZARDOUS WASTE STORAGE AREA
RICKENBACKER ANGB
CROSS-SECTION OF SUBSURFACE
LITHOLOGIES FROM A TO A'.

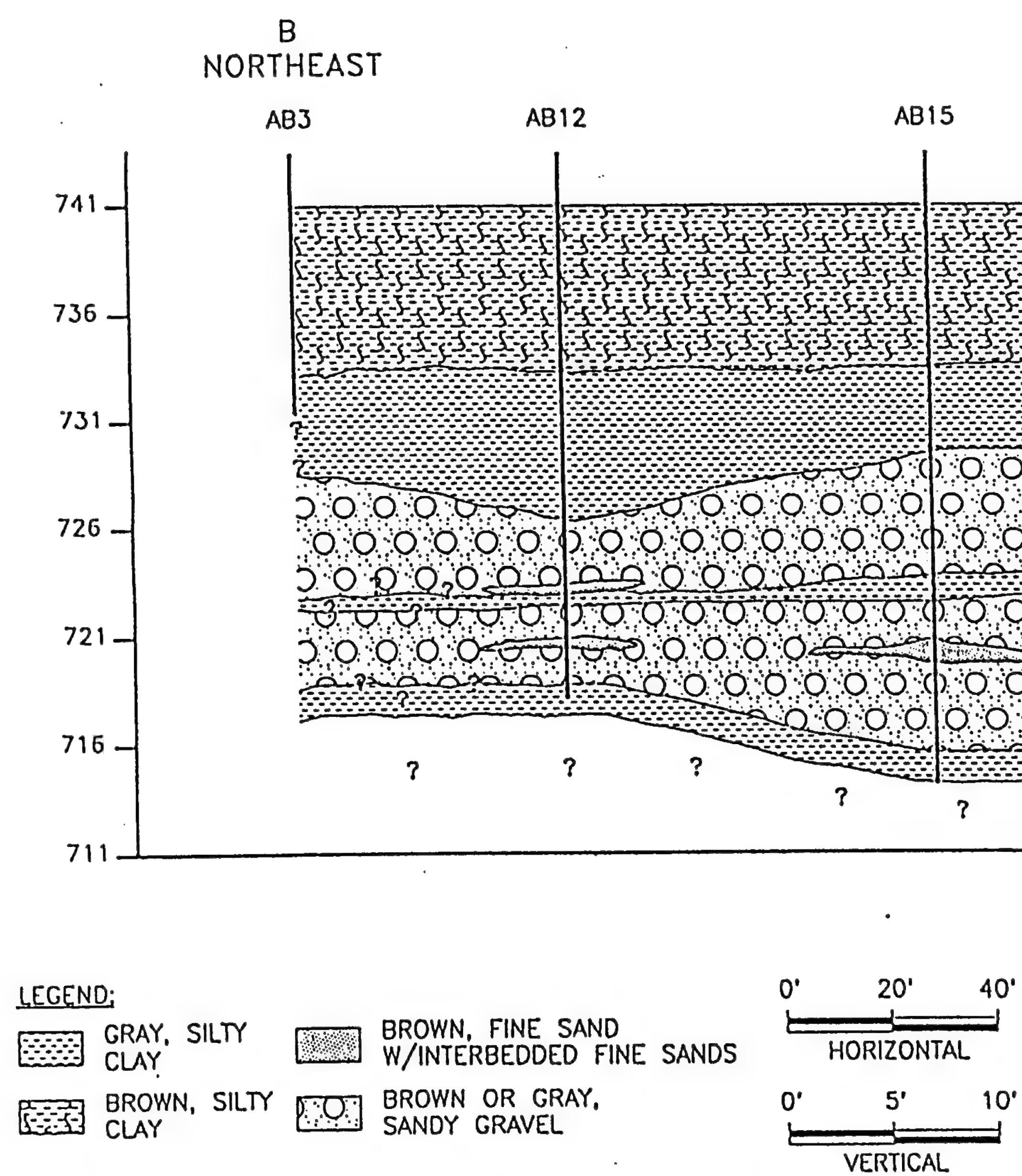


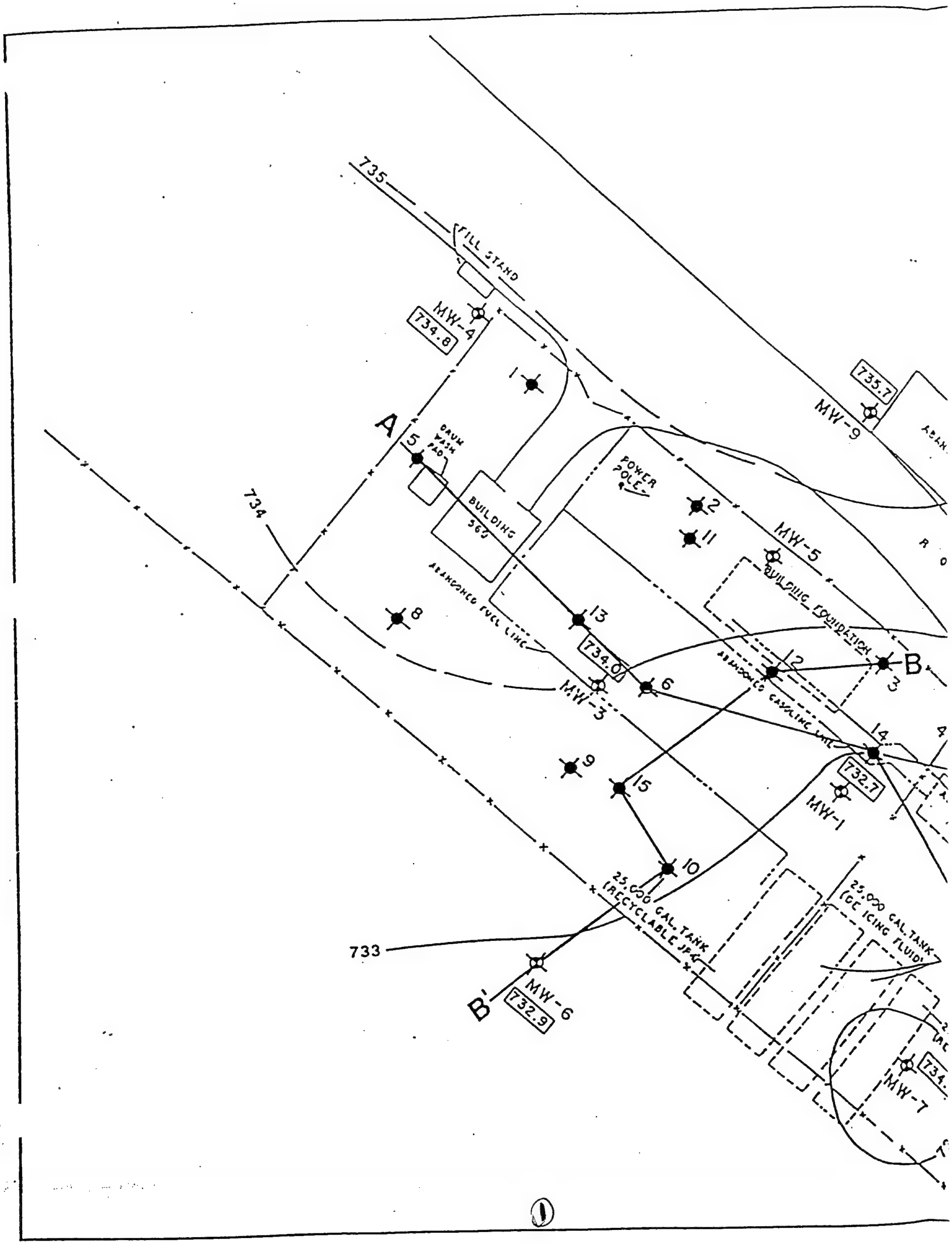
FIGURE B.2

HAZARDOUS WASTE STORAGE AREA
RICKENBACKER ANGB
CROSS-SECTION OF SUBSURFACE
LITHOLOGIES FROM B TO B'

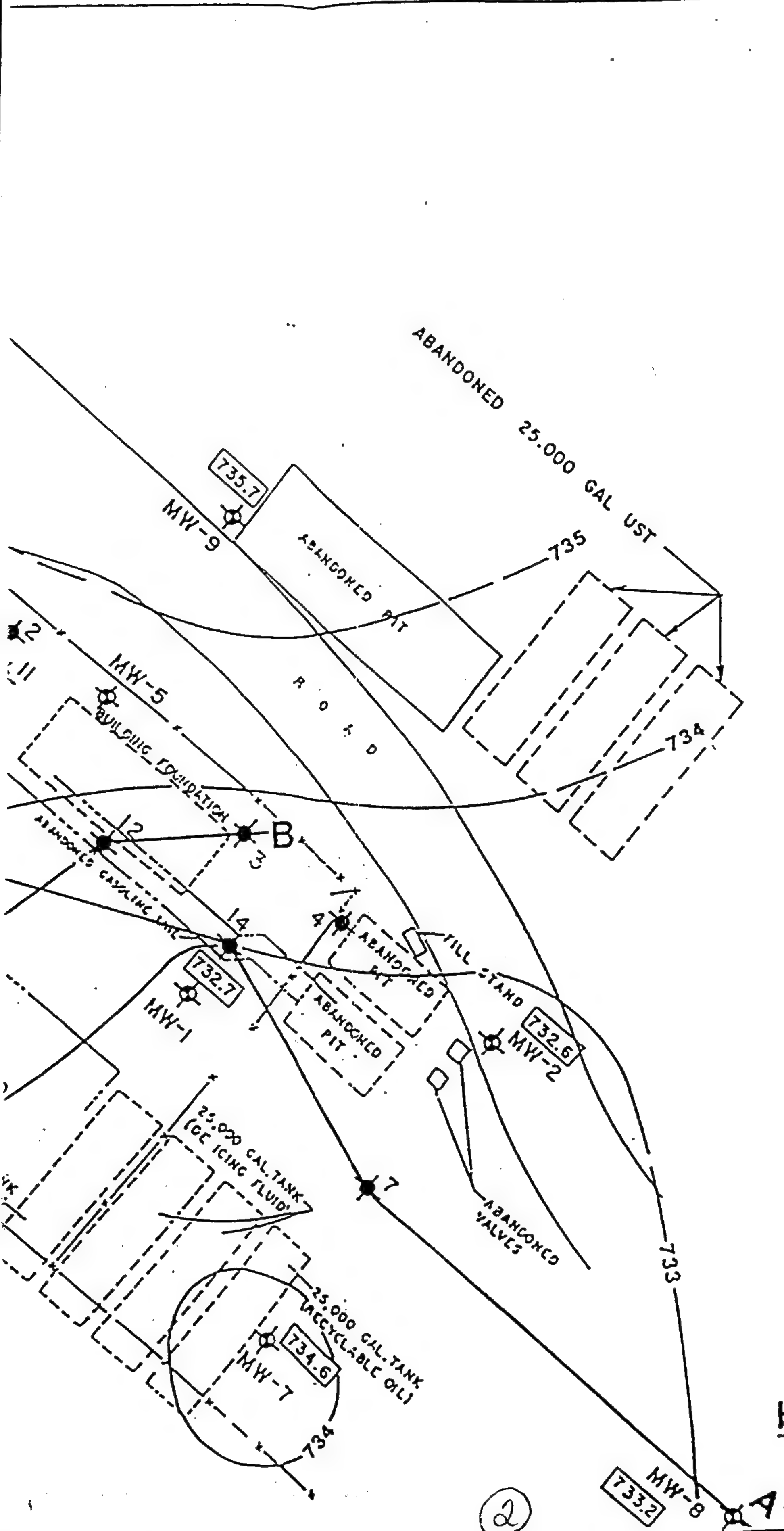
0115004

No VOCs were detected in the soils from borings from MW10, MW11 and MW12.

Metals analysis from the soil samples obtained from the soil borings were also compared to the background levels for the Base. Detected above background criteria were arsenic, beryllium, cadmium, chromium, copper.


735
FILL STAND
MW-4
734.8
735.7
MW-9
A
5
WASH PAD
BUILDING 560
POWER POLE
734
ABANDONED FUEL LINE
MW-5
BUILDING FOUNDATION
734.0
MW-3
ABANDONED GASOLINE LINE
B
732.7
MW-1
25,000 GAL. TANK (RECYCLABLE JP-4)
25,000 GAL. TANK (DE-ICING FLUID)
733
B'
MW-6
732.9
MW-7

①



LEGEND :

1	RB-HW-AB1
2	RB-HW-AB2
3	RB-HW-AB3
4	RB-HW-AB4
5	RB-HW-AB5
6	RB-HW-AB6
7	RB-HW-AB7
8	RB-HW-AB8
9	RB-HW-AB9
10	RB-HW-AB10
11	RB-HW-AB11
12	RB-HW-AB12
13	RB-HW-AB13
14	RB-HW-AB14
15	RB-HW-AB15

FIGURE B.3

CROSS-SECTION LOCAT

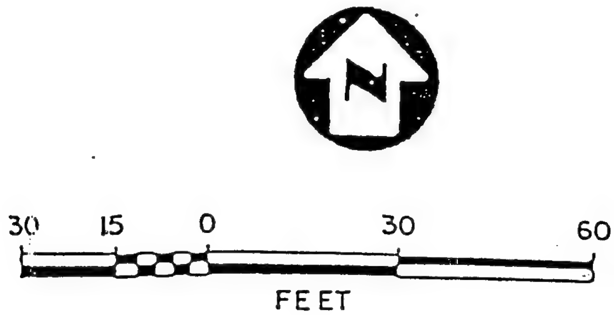
WATER SURFACE M

HAZARDOUS WASTE STO

RICKENBACKER ANG

6 FEBRUARY 1990

(2)



LEGEND :

1	RB-HW-AB1
2	RB-HW-AB2
3	RB-HW-AB3
4	RB-HW-AB4
5	RB-HW-AB5
6	RB-HW-AB6
7	RB-HW-AB7
8	RB-HW-AB8
9	RB-HW-AB9
10	RB-HW-AB10
11	RB-HW-AB11
12	RB-HW-AB12
13	RB-HW-AB13
14	RB-HW-AB14
15	RB-HW-AB15

FIGURE B.3

CROSS-SECTION LOCATION AND WATER SURFACE MAP

HAZARDOUS WASTE STORAGE AREA

RICKENBACKER ANGB, OHIO

3 6 FEBRUARY 1990

ES ENGINEERING—SCIENCE

GROUNDWATER SURVEY
RICKENBACKER ANGB, OHIO

October 1991

Prepared for:

Engineering Science
Cleveland, Ohio

Project 533935

BURLINGTON ENVIRONMENTAL, MATHES DIVISION
4091 Venture Place
Groveport, Ohio 43125

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LIST OF TABLES

GROUNDWATER SURVEY
RICKENBACKER ANGB, OHIO

1. INTRODUCTION

Engineering Science (ES) requested that John Mathes & Associates, Inc., (Mathes) perform a groundwater survey at the site located at Rickenbacker ANGB, Ohio.

The purpose of this survey was to evaluate the potential presence, and estimate the extent of impact, of volatile organic compounds (VOCs) at the above mentioned facility. This survey was performed by obtaining and analyzing groundwater samples on site.

Mathes arrived at the facility on October 7, 1991. Groundwater sampling was performed from October 7 to October 9, 1991.

2 SUMMARY

Twenty one groundwater samples from 17 probe hole locations were collected and analyzed. Three duplicate groundwater samples, and ten sample blanks were also analyzed. Samples were analyzed for the following chemicals:

- o benzene;
- o ethylbenzene;
- o m&p-xylene;
- o o-xylene;
- o toluene;
- o trichloroethylene;

The analytical results are summarized in Table 1. Site maps with sample locations are being prepared by ES.

3 SAMPLING LOCATIONS

Groundwater samples were collected on site at locations suspected by ES to be impacted with VOCs. Sampling locations were selected by ES based on on-site soil boring data previously obtained by ES, the location of underground utilities, groundwater flow, and vehicle accessibility.

Sampling locations were mapped by ES. At the request of ES, a sampling location map is not included in this report.

TABLE 1

GROUNDWATER ANALYTICAL RESULTS

RICKENBACKER ANGB, OHIO

			Concentration (ug/L)					
Sample I.D.	Probe Hole Number	Depth (Feet)	Benzene	Trichloroethylene	Toluene	Ethylbenzene	Total Xylenes	Comments
BLANK-01	-	-	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	QC-System Blank
BLANK-02	-	-	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	QC-Probe Rod Blank
GW-01	PH-01	16.0	8	ND(1)	ND(1)	ND(1)	ND(1)	Groundwater
GW-02	PH-02	21.0	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	Groundwater
GW-02D	PH-02	21.0	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	QC-Duplicate
GW-03	PH-03	20.0	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	Groundwater
GW-04	PH-04	16.0	ND(1)	55	1385	393	259	Groundwater
BLANK-03	-	-	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	QC-System Blank
BLANK-04	-	-	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	QC-System Blank
BLANK-05	-	-	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	QC-Probe Rod Blank
GW-05	PH-05	20.0	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	Groundwater
GW-06	PH-06	20.0	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	Groundwater
GW-07	PH-07	20.0	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	Groundwater
GW-08	PH-08	24.0	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	Groundwater
GW-09	PH-09	24.0	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	Groundwater

ND Not detected at the detection limit in parentheses

QC Quality Control

ug/L Micrograms per liter

\- Not Applicable

TABLE 1

GROUNDWATER ANALYTICAL RESULTS

RICKENBACKER ANGB, OHIO

Sample I.D.	Probe Hole Number	Depth (Feet)	Concentration (ug/L) Benzene	Trichloroethylene	Toluene	Ethylbenzene	Total Xylenes	Comments
GW-10	PH-10	24.0	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	Groundwater
GW-11	PH-11	24.0	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	Groundwater
GW-12	PH-12	24.0	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	Groundwater
GW-13	PH-13	24.0	168	ND(1)	ND(1)	ND(1)	ND(1)	Groundwater
BLANK-06	-	-	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	QC-System Blank
GW-14	PH-14	18.0	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	Groundwater
GW-14D	PH-14	18.0	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	QC-Duplicate
BLANK-07	-	-	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	QC-System Blank
BLANK-08	-	-	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	QC-System Blank
BLANK-09	-	-	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	QC-Probe Rod Blank
GW-15	PH-06	22.0	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	Groundwater
GW-16	PH-06	20.0	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	Groundwater
GW-17	PH-06	18.0	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	Groundwater
GW-18	PH-06	16.0	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	Groundwater
GW-19	PH-15	20.0	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	Groundwater
GW-20	PH-16	20.0	4	ND(1)	ND(1)	ND(1)	ND(1)	Groundwater
GW-20D	PH-16	20.0	3	ND(1)	ND(1)	ND(1)	ND(1)	QC-Duplicate
GW-21	PH-17	20.0	172	ND(1)	ND(1)	6	ND(1)	Groundwater
BLANK-10	-	-	ND(1)	ND(1)	ND(1)	ND(1)	ND(1)	QC-System Blank

Twenty one groundwater samples and three duplicate groundwater samples were collected from 17 locations using the RECON^{SM} System equipment. Samples were collected from a depth of 16 to 24 feet. Analytical results for the groundwater samples are presented in Table 1.

A hydraulic probe unit was used to drive and withdraw the groundwater sampling probes. A hydraulic hammer was used where necessary to assist in driving probes through unusually hard soil. The probes consisted of three-foot lengths of 0.75-inch-diameter threaded steel pipes with detachable drive points.

After the probe was inserted into the groundwater, the probe was withdrawn approximately one foot to create an annular space from which to collect a representative sample. A check valve attached to a length of polyethylene tubing was inserted through the probe into the water table. The sample was collected in the tubing, the tubing was pulled up, and the water in the tubing drained into a 40-milliliter (mL) glass vial sealed with a Teflon-lined septum screw cap. The sample was given to the GC technician for on-site analysis.

A Hewlett-Packard Model 5890A Series II gas chromatograph (GC) was used for the analysis of groundwater samples. Compound separation and detection were performed using a 30-meter wide-bore DB-624 volatile organic column and a flame-ionization detector (FID). Appendix A contains the GC field work sheets.

The groundwater samples were analyzed by modified U.S. Environmental Protection Agency (USEPA) Method 601/602. Modifications include use of a FID, a static headspace analysis, single-point calibration, and limited quality control measures.

Each sample vial was shaken for two minutes and heated at 70^{o} C for 10 minutes to equlibrate the volatile components between the liquid and the air in the vial. An aliquot of up to 400 microliters of the headspace was collected by inserting a syringe through the septum of the vial and pulling the headspace sample into the syringe. The sample was then injected directly into the GC.

Concentrations were measured based on an external standard calibration. Known concentrations of benzene, ethylbenzene, meta & para-xylene, ortho-xylene, toluene, and trichloroethylene were injected as a calibration gas mixture into the GC. Compound peak area versus standard concentration was used to calculate sample concentrations.

Compound identification was based on comparison of target compound retention times with sample unknowns.

Analytical results for the groundwater sample analyzed by this technique will not necessarily be the same as those obtained by submitting the same groundwater sample for laboratory analysis. Different extraction techniques are used in each case and, although method sensitivities and accuracies are comparable, different results are possible.

The detection limit is the lowest concentration of a compound that can be practicably measured relative to the calibration standard. Detection limits are a function of the injection volume, as well as detector sensitivity. The detection limit is calculated from the current response factor, the sample size, and the estimated peak area that would have been detected under the given conditions. For this survey, the detection limit for each of the target compounds, was 1 microgram per liter (ug/L).

5 QUALITY CONTROL

Quality control is an essential part of an analytical test methodology. Quality control procedures increase the confidence in the analytical results and are used to evaluate the reproducibility of the data.

The GC was calibrated using a known concentration of each of the target compounds of interest at the beginning of the day before analysis of any samples. The USEPA recommends instrument calibration be performed at least once every 12 hours. The calibration helps to evaluate the operating conditions of the GC.

A chromatographic system blank is analyzed every 10 samples as a means of indication that sample carryover has not occurred. If sample carryover has occurred, the concentration detected in the system blank can be subtracted from any of the subsequent samples containing that compound. A probe rod blank is analyzed prior to sample collection to ensure that rods are free of contamination.

A duplicate sample, which is a second volume of soil-gas, groundwater, or soil collected from the same sample location, is analyzed once every 20 samples, or at least once daily for each survey. Three duplicate groundwater samples were collected at Probe Holes PH-2, PH-14, and PH-20. Duplicates are used to evaluate the reproducibility of the analytical data. The analytical results for each of the respective duplicate samples collected at Probe Holes PH-2, PH-14, and PH-20 were within the specified limit of plus or minus 20 percent.

Appendix A

Gas Chromatograph
Field Work Sheets

RECON[sm] SAMPLE ANALYSIS WORK SHEET

ate 10-7-91 Project Name Rickenbacker, ANGB Project Number 533935 Phase 1003 Task 77

C Operator Nick Crano Equipment: GC Hewlett-Packard 5890 A

arrier Gas: H2 ✓ He Pressure (kPa) 100 Detector FID Temp. (C) 300

ven Temp. Profile (C) Temp. 1 70 Time 1 10 min Temp. 2 Time 2 Final Temp.

Column DB-624 / 30 meter 0.53 ✓ SE-54 / 15 meter 0.53

njector Temp. (C) 200

Sample I.D.	Probe Hole Number	Depth (ft)	Analysis Time	Inj. Vol. (ul)	Multiplier	VAC in. Hg	Comments
BLANK-01	-	-	9:19	400	0.25	-	QC-SYSTEM BLANK
STD-1007	-	-	9:34	100	1.0	-	CALIBRATION STD
BLANK-02	-	-	11:09	400	0.25	-	QC-ROD BLANK
GW-01	PH-01	16'	11:34	400	0.25	-	GROUND WATER
GW-02	PH-02	21'	12:35	400	0.25	-	GROUNDWATER
GW-02D	PH-02	21'	12:48	400	0.25	-	QC-DUPLICATE
GW-03	PH-03	20'	14:07	400	0.25	-	GROUNDWATER
GW-04	PH-04	16'	15:35	50	2.0	-	GROUNDWATER
BLANK.03	-	-	16:24	400	0.25	-	QC-SYSTEM BLANK
RT-01	-	-	16:36	100	1.0	-	QC-RT CHECK

-duplicate sample analysis
C=quality control

RECON(tm) SAMPLE ANALYSIS
WORK SHEET

te 10-8-91 Project Name Rickenbacker ANGB Project Number 533935 Phase 1003 Task 77

Operator Nick Crane Equipment: GC Hewlett-Packard 5890 A

rrier Gas: H2 ✓ He Pressure (kPa) 100 Detector FID Temp. (C) 300

en Temp. Profile (C) Temp. 1 70° Time 1 10 min Temp. 2 ____ Time 2 ____ Final Temp. ____

Column DB-624 / 30 meter 0.53 ✓
SE-54 / 15 meter 0.53 ____

jector Temp. (C) 200

mple I.D.	Probe Hole Number	Depth (ft)	Analysis Time	Inj. Vol. (ul)	Multiplier	VAC in. Hg	Comments
BLANK-04	–	–	7:16	400	0.25	–	QC-SYSTEM BLANK
STD-1008	–	–	7:47	100	1.0	–	CALIBRATION STD.
BLANK-05	–	–	8:05	400	0.25	–	QC-ROD BLANK
GW-05	PH-05	20'	8:57	400	0.25	–	GROUND WATER
GW-06	PH-06	20'	10:09	400	0.25	–	GROUND WATER
GW-07	PH-07	20'	10:33	400	0.25	–	GROUND WATER
GW-08	PH-08	24'	12:04	400	0.25	–	GROUND WATER
GW-09	PH-09	24'	13:40	400	0.25	–	GROUND WATER
GW-10	PH-10	24'	14:12	400	0.25	–	GROUND WATER
GW-11	PH-11	24'	14:41	400	0.25	–	GROUND WATER
GW-12	PH-12	24'	15:12	400	0.25	–	GROUND WATER
GW-13	PH-12	24'	15:43	400	0.25	–	GROUND WATER

-duplicate [illegible]ple analysis

RECON(TM) SAMPLE ANALYSIS WORK SHEET

ate 12-4-91 Project Name Rickenbacker ANGB Project Number 533935 Phase 1003 Task 77

Operator Nick Crano Equipment: GC Hewlett-Packard 5890 A

rrier Gas: H2 ✓ He Pressure (kPa) 100 Detector FID Temp.(C) 300

ven Temp. Profile (C) Temp. 1 70° Time 1 10 min Temp. 2 ____ Time 2 ____ Final Temp. ____

Column DB-624 / 30 meter 0.53 ✓
SE-54 / 15 meter 0.53 ____

jector Temp. (C) 200

ample I.D.	Probe Hole Number	Depth (ft)	Analysis Time	Inj. Vol. (ul)	Multiplier	VAC in. Hg	Comments
BLANK-06	–	–	16:00	400	0.25	–	QC-SYSTEM BLANK
GW-14	PH-14	18'	16:29	400	0.25	–	GROUND WATER
GW-14D	PH-14	18'	16:41	400	0.25	–	QC-DUPLICATE
BLANK-07	–	–	16:54	400	0.25	–	QC-SYSTEM BLANK
RT-01	–	–	17:05	100	1.0	–	QC-RT CHECK

-duplicate sample analysis
-quality control

RECON[m] SAMPLE ANALYSIS
WORK SHEET

te 10-9-91 Project Name Rickenbacker ANGB Project Number 533935 Phase 1003 Task 77

Operator Nick Cruo Equipment: GC Hewlett-Packard 5890 A

rrier Gas: H2✓ He Pressure (kPa) 100 Detector FID Temp.(C) 300

en Temp. Profile (C) Temp. 1 70° Time 1 10 min Temp. 2 Time 2 Final Temp.

Column DB-624 / 30 meter 0.53 ✓
SE-54 / 15 meter 0.53

jector Temp. (C) 200

ample I.D.	Probe Hole Number	Depth (ft)	Analysis Time	Inj. Vol. (ul)	Multiplier	VAC in. Hg	Comments
BLANK-08	-	-	7:13	400	0.25	-	QC-SYSTEM BLANK
STD-1009	-	-	7:45	100	1.0	-	CALIBRATION STD
BLANK-09	-	-	8:11	400	0.25	-	QC-ROD BLANK
GW-15	PH-06	22'	9:05	400	0.25	-	GROUND WATER
GW-16	PH-06	20'	9:30	400	0.25	-	GROUND WATER
GW-17	PH-06	18'	9:50	400	0.25	-	GROUND WATER
GW-18	PH-06	16'	10:11	400	0.25	-	GROUND WATER
GW-19	PH-15	20'	11:44	400	0.25	-	GROUND WATER
GW-20	PH-16	20'	12:14	400	0.25	-	GROUND WATER
GW-20D	PH-16	20'	12:27	400	0.25	-	QC-DUPLICATE
GW-21	PH-17	20'	12:40	400	0.25	-	GROUND WATER
BLANK-10	-	-	12:57	400	0.25	-	QC-SYSTEM BLANK

*duplicate sample analysis

RECON[sm] SAMPLE ANALYSIS WORK SHEET

Date 10-9-91 Project Name Rickenbacker ANGB Project Number 533935 Phase 1003 Task 77

GC Operator Nick Cimo Equipment: GC Hewlett-Packard 5890 A

Carrier Gas: H2 ✓ He Pressure (kPa) 100 Detector FID Temp.(C) 300

Oven Temp. Profile (C) Temp. 1 70 Time 1 10 min Temp. 2 ____ Time 2 ____ Final Temp. ____

Column DB-624 / 30 meter 0.53 ✓
SE-54 / 15 meter 0.53

Injector Temp. (C) 200

Sample I.D.	Probe Hole Number	Depth (ft)	Analysis Time	Inj. Vol. (ul)	Multiplier	VAC in. Hg	Comments
RT-03	—	—	13:08	100	1.0.	✓	QC-RT CHECK

*=duplicate sample analysis
C=quality control

Appendix B

Gas Chromatograph Plots

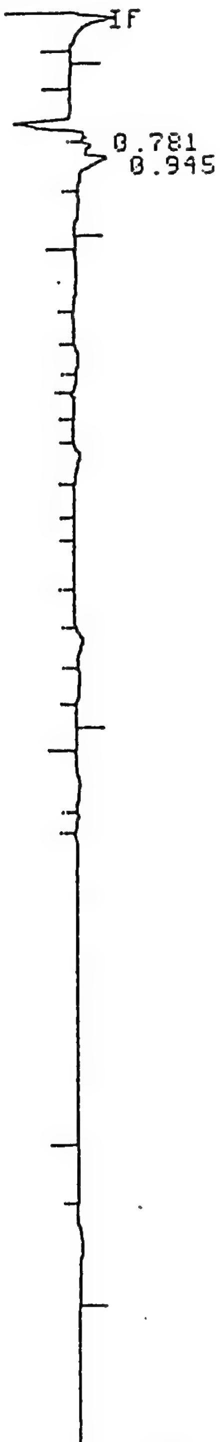
+ TIME BREAK

+ OP # 7

DEFAULT SAMPLE INFORMATION
USE SAMPLE TABLE IN MANUAL RUN [Y/N+]:

ISTD AMT [0.0000E+00]:
SAMPLE AMT [0.0000E+00]:
MUL FACTOR [2.5000E-01]:
RECALIBRATION [Y/N*]:
NAME: BLANK-01
REPORT MEMO:

* RUN # 2 OCT 7, 1991 09:19:48
START



STOP

Closing signal file B:0562F...

RUN #   2-002

RUN#   2   OCT 7, 1991 09:19:48

SAMPLE NAME: BLANK-01

SIGNAL FILE: B:Q362ACB5.BNC

MATHES RECON MULTIMEDIA ANALYSIS

NO CALIB PEAKS FOUND

AREA%

RT	AREA	TYPE	WIDTH	AREA%
.781	8677	PU	.079	6.07259
.945	27045	UU	.215	18.92742

TOTAL AREA= 35722

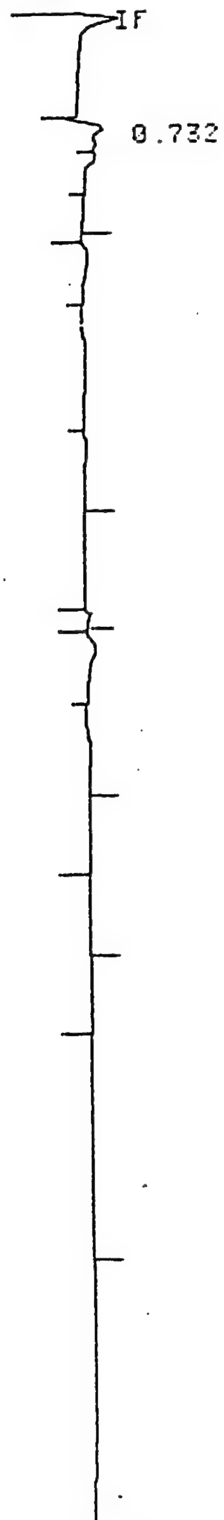
MUL FACTOR=2.5000E-01

OP # 7

DEFAULT SAMPLE INFORMATION
USE SAMPLE TABLE IN MANUAL RUN [Y/N*]:

ISTD AMT [0.0000E+00]:
SAMPLE AMT [0.0000E+00]:
MUL FACTOR [2.5000E-01]:
RECALIBRATION [Y/N*]:
NAME: BLANK-02
REPORT MEMO:

* RUN # 4 OCT 7, 1991 11:09:20
START



Closing signal file B:Q362C662.BNC

RUN# 4 OCT 7, 1991 11:09:20

SAMPLE NAME: BLANK-02

SIGNAL FILE: B:Q362C662.BNC

MATHES RECON MULTIMEDIA ANALYSIS

NO CALIB PEAKS FOUND

AREA%

RT	AREA	TYPE	WIDTH	AREA%
.732	9054	BV	.144	25.00000

TOTAL AREA= 9054

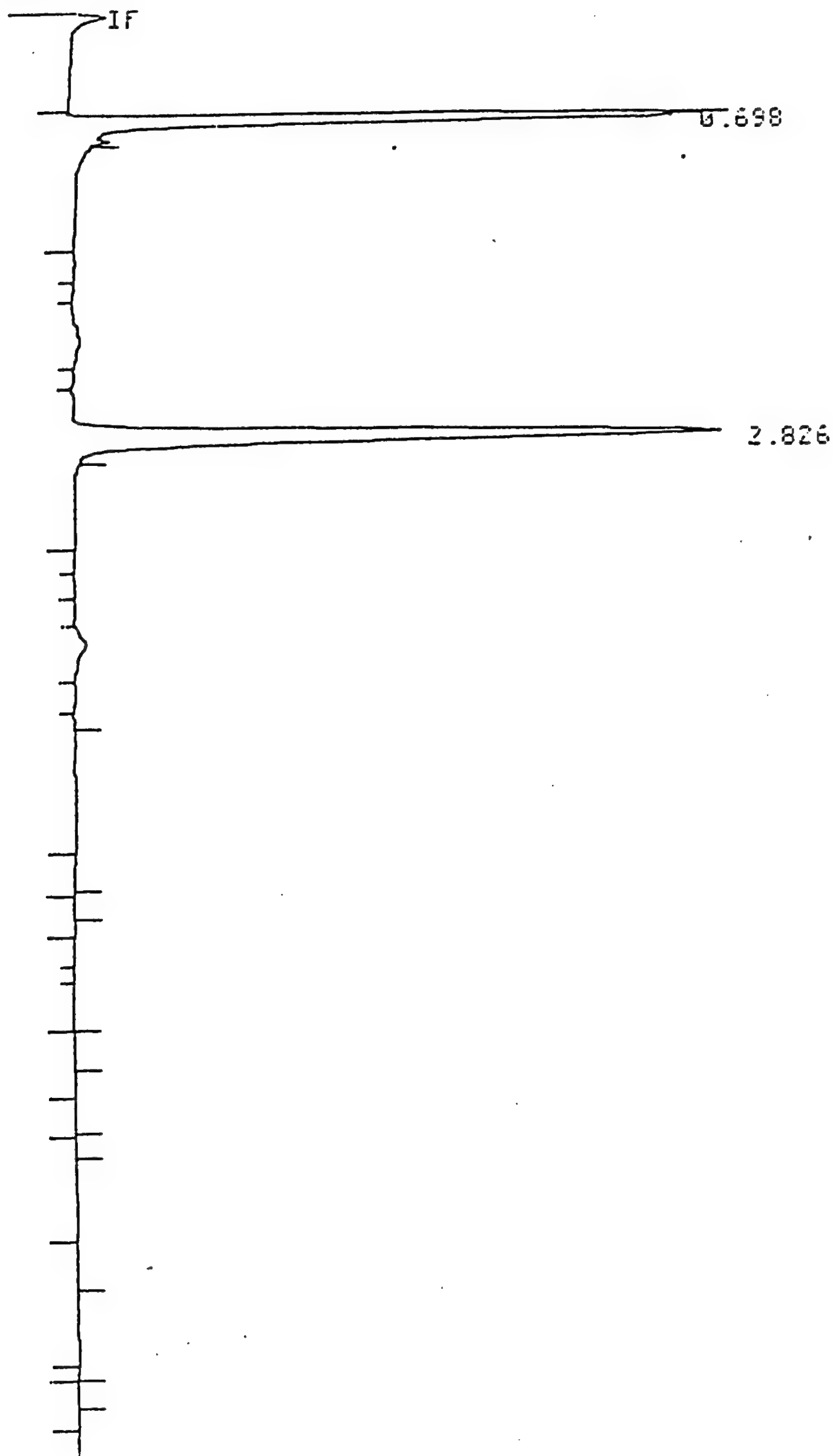
MUL FACTOR=2.5000E-01

[illegible]

DEFAULT SAMPLE INFORMATION
USE SAMPLE TABLE IN MANUAL RUN [Y/N*]:

ISTD AMT [0.0000E+00]:
SAMPLE AMT [0.0000E+00]:
MUL FACTOR [2.5000E-01]:
RECALIBRATION [Y/N*]:
NAME: GW-02
REPORT MEMO: PH-02

* RUN # 6 OCT 7, 1991 12:35:37
START



Closing [illegible] file B:036CDA9A.BNC

RUN# 5 OCT 7, 1991 12:35:37

SAMPLE NAME: SW-02
PH-02

SIGNAL FILE: B:Q362DA9A.BNC

MATHES RECON MULTIMEDIA ANALYSIS

ESTD-AREA

RT	TYPE	AREA	WIDTH	CAL#	ug/L	NAME
.698	PB	70913	.061		.000	
2.826	PB	99953	.089	3R	.000	INT. STD.

TOTAL AREA= 170866
MUL FACTOR=2.5000E-01

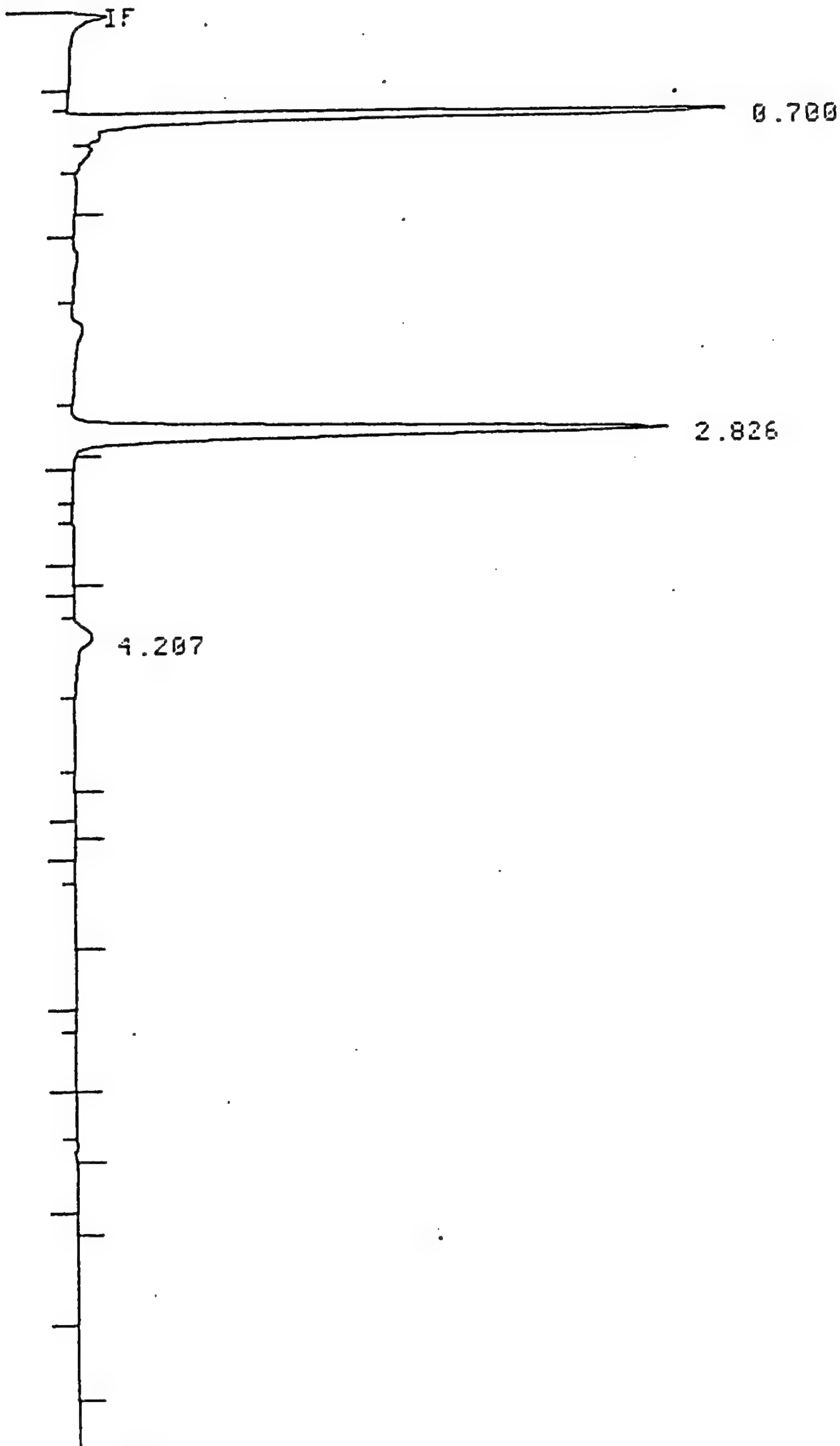
GRP#	ug/L	NAME
1	0.0000E+00	TOTAL XYLENES

* OP # 7

DEFAULT SAMPLE INFORMATION
USE SAMPLE TABLE IN MANUAL RUN [Y/N*]:

ISTD AMT [0.0000E+00]:
SAMPLE AMT [0.0000E+00]:
MUL FACTOR [2.5000E-01]:
RECALIBRATION [Y/N*]:
NAME: GW-02D
REPORT MEMO: PH-02

* RUN #   7   OCT 7, 1991 12:48:59
START



STOP

[illegible]

RUN# 7 OCT 7, 1991 12:48:59

SAMPLE NAME: GW-02D
PH-02

SIGNAL FILE: B:Q3620DBC.BNC

MATHES RECON MULTIMEDIA ANALYSIS

ESTD-AREA

RT	TYPE	AREA	WIDTH	CAL#	ug/L	NAME
.700	PV	68409	.059		.000	
2.826	PB	85853	.082	3R	.000	INT. STD.
4.207	VP	5293	.155		.000	

TOTAL AREA= 159555
MUL FACTOR=2.5000E-01

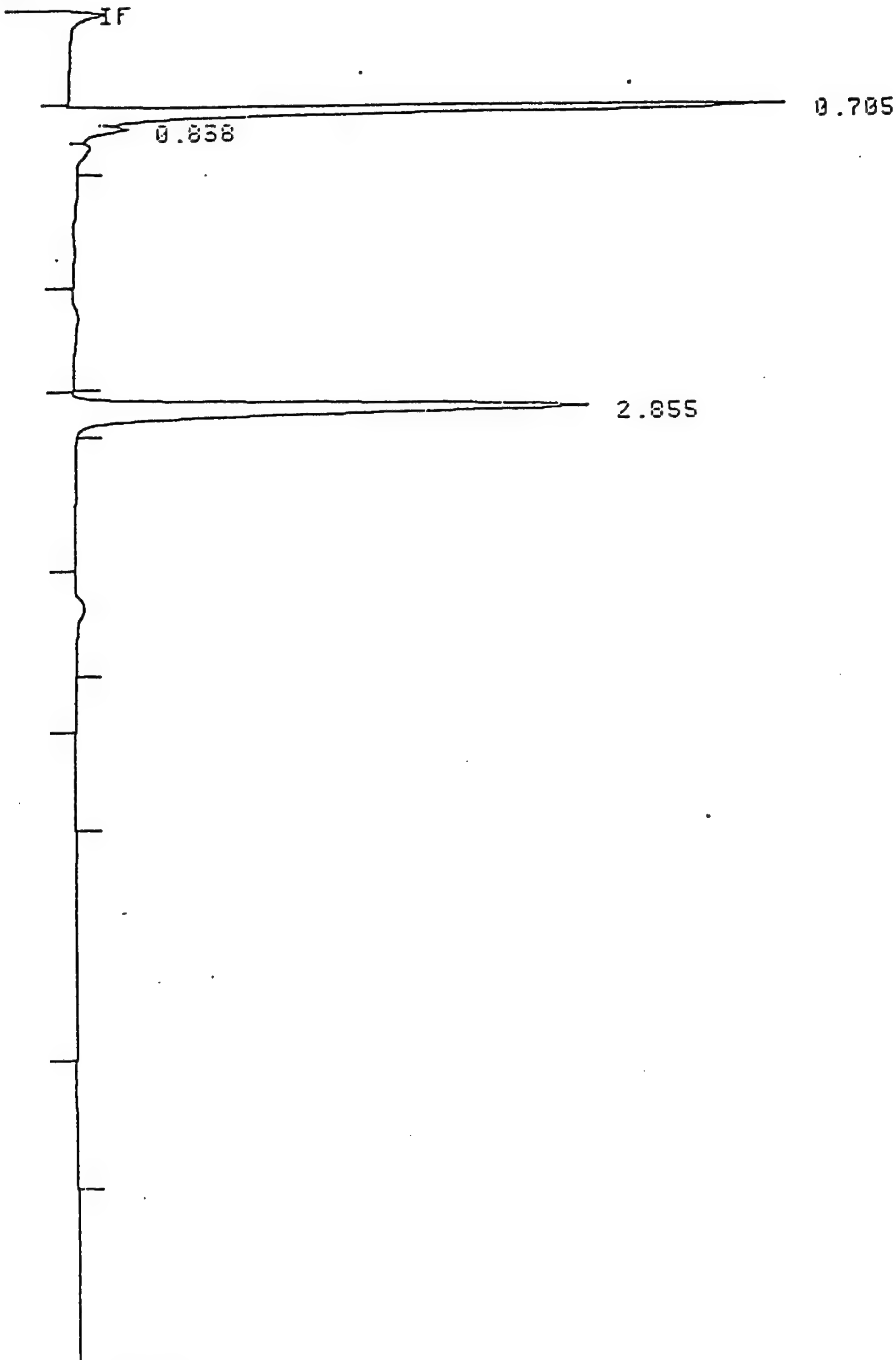
GRP#	ug/L	NAME
1	0.0000E+00	TOTAL XYLENES

\+ OP # 7

DEFAULT SAMPLE INFORMATION
USE SAMPLE TABLE IN MANUAL RUN [Y/N*]:

ISTD AMT [0.0000E+00]:
SAMPLE AMT [0.0000E+00]:
MUL FACTOR [2.5000E-01]:
RECALIBRATION [Y/N*]:
NAME: GW-03
REPORT MEMO: PH-03

* RUN # 8 OCT 7, 1991 14:07:03
START



STOP

RUN# 8 OCT 7, 1991 14:07:03

SAMPLE NAME: GW-03
PH-03

SIGNAL FILE: B:Q362F008.BNC

MATHES RECON MULTIMEDIA ANALYSIS

ESTD-AREA

RT	TYPE	AREA	WIDTH	CAL#	ug/L	NAME
.705	PV	83711	.062		.000	
.838	VV	6755	.062		.000	
2.855	PB	87170	.090	5R	.000	INT. STD.

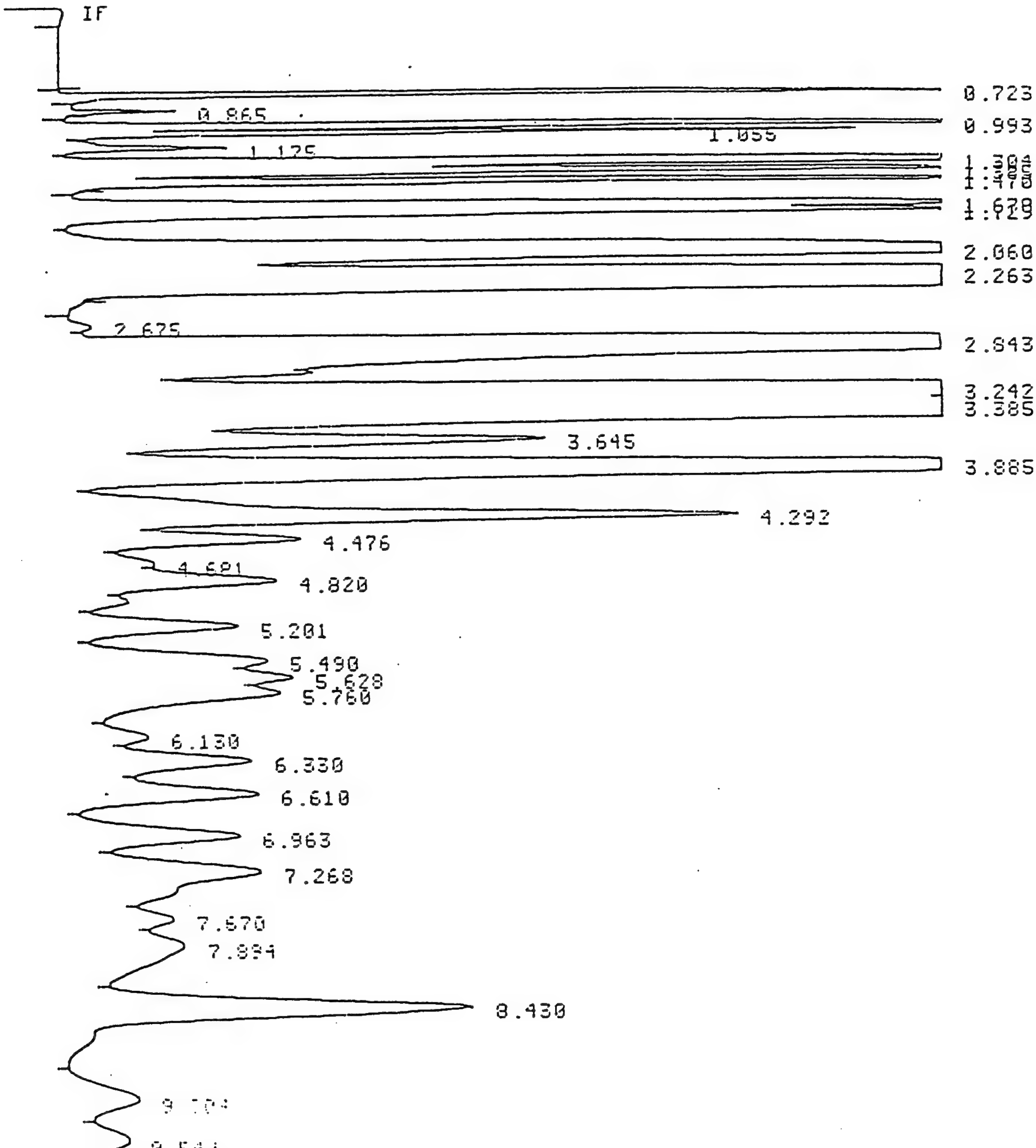
TOTAL AREA= 177636
MUL FACTOR=2.5000E-01

GRP#	ug/L	NAME
1	0.0000E+00	TOTAL XYLENES

DEFAULT SAMPLE INFORMATION
USE SAMPLE TABLE IN MANUAL RUN [Y/N*]:

ISTD AMT [0.0000E+00]:
SAMPLE AMT [0.0000E+00]:
MUL FACTOR [2.5000E-01]: 2
RECALIBRATION [Y/N*]:
NAME: GW-04
REPORT MEMO: PH-04

* RUN # 10 OCT 7, 1991 15:35:13
START



STOP

Closing signal file B:03650482.BNC

RUN# 10 OCT 7, 1991 15:35:13

SAMPLE NAME: GW-04
PH-04

SIGNAL FILE: B:Q36304B2.BNC

MATHES RECON MULTIMEDIA ANALYSIS

ESTD-AREA

RT	TYPE	AREA	WIDTH	CAL#	ug/L	NAME
.723	PB	109018	.021		.000	
.865	BB	6165	.025		.000	
.995	BV	196771	.029		.000	
1.055	VV	50451	.029		.000	
1.175	VP	16644	.045		.000	
1.304	PV	342242	.041		.000	
1.385	VV	112840	.042		.000	
1.470	VB	97149	.039		.000	
1.670	BV	165499	.053		.000	
1.729	VP	108061	.050		.000	
2.060	PV	425747	.105		.000	
2.263	VB	1761999	.085		.000	
2.675	PV	3987	.070	2	54.940	TCE
2.843	VV	817443	.116	3R	.000	INT. STD.
3.242	VV	745023	.094		.000	
3.385	VV	1091792	.116		.000	
3.645	VV	116104	.111		.000	
3.885	VV	449209	.128		1385.000	Toluene
4.292	VV	190415	.129		.000	
4.476	VV	62069	.120		.000	
4.681	VV	20081	.102		.000	
4.820	VV	67472	.145		.000	
5.201	VV	50624	.133		.000	
5.490	VV	61399	.138		.000	
5.628	VV	65131	.131		.000	
5.760	VV	84455	.179		.000	
6.130	VV	28627	.155		.000	
6.350	VV	69667	.171		.000	
6.610	VV	69522	.164		.000	
6.963	VV	64344	.168		.000	
7.268	VV	120983	.282	5	392.725	ETHYLBENZENE
7.670	VV	42048	.175		135.000	m & P- Xylene
7.894	VV	88864	.339	~~6~~	~~[illegible]~~	~~M&P XYLENE~~
8.430	VP	169007	.190		.000	
9.204	PV	38319	.237	7	123.556	O-XYLENE
9.544 I	VH	35276	.255		.000	

TOTAL AREA=7944448
MUL FACTOR=2.0000E+00

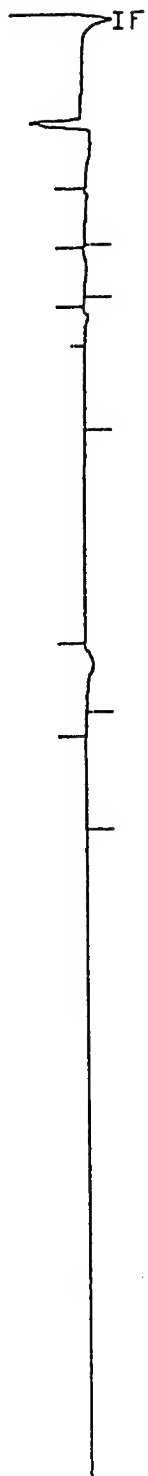
GRP#	ug/L	NAME
1	4.0956E+02	TOTAL XYLENES

* OP # 7

DEFAULT SAMPLE INFORMATION
USE SAMPLE TABLE IN MANUAL RUN [Y/N*]:

ISTD AMT [0.0000E+00]:
SAMPLE AMT [0.0000E+00]:
MUL FACTOR [1.0000E+01]: .25
RECALIBRATION [Y/N*]:
NAME: BLANK-03
REPORT MEMO: PH-[illegible]

*
* RUN # 12 OCT 7, 1991 16:24:48
START



STOP

RUN#   12   OCT 7, 1991 16:24:48

SAMPLE NAME: BLANK-03

SIGNAL FILE: B:Q3631051.BNC

MATHES RECON MULTIMEDIA ANALYSIS

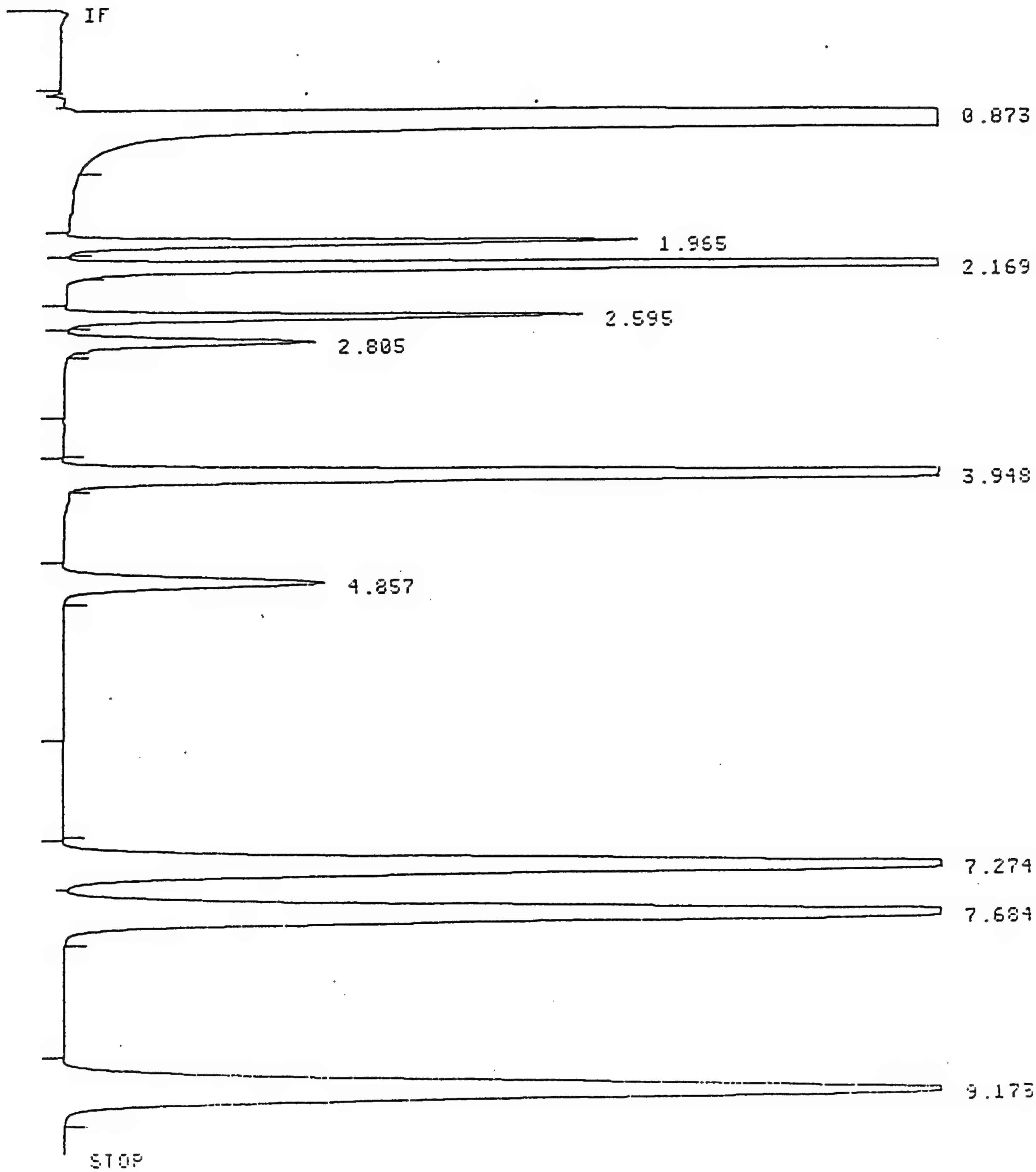
NO RUN PEAKS STORED

\+ OP # 7

DEFAULT SAMPLE INFORMATION
USE SAMPLE TABLE IN MANUAL RUN [Y/N*]:

ISTD AMT [0.0000E+00]:
SAMPLE AMT [0.0000E+00]:
MUL FACTOR [1.0000E+00]:
RECALIBRATION [Y/N*]:
NAME: RT-01
REPORT MEMO:

* RUN # 14 OCT 7, 1991 16:49:03
START



Closing signal file B:03631600.BNC

SAMPLE NAME: RT-01

SIGNAL FILE: B:03631600.BNC

MATHES RECON MULTIMEDIA ANALYSIS

ESTD-AREA

RT	TYPE	AREA	WIDTH	CAL#	ug/L	NAME
					.000	
.873	SHB	27081440	.031		.000	
1.965	PB	71068	.056			
2.169	BB	330730	.052	1	466.685	BENZENE
2.595	PB	66477	.058	2	458.019	TCE
2.805	PB	39011	.072	3R	.000	INT. STD.
3.948	PB	298462	.082	4	459.967	TOLUENE
4.857	PB	57835	.101		.000	
7.274	PV	313070	.137	5	508.130	ETHYLBENZENE
7.684	VB	329346	.143	6	529.990	M&P-XYLENE
9.173	PB	335121	.167	7	540.284	O-XYLENE

TOTAL AREA=2.8923E+07
MUL FACTOR=1.0000E+00

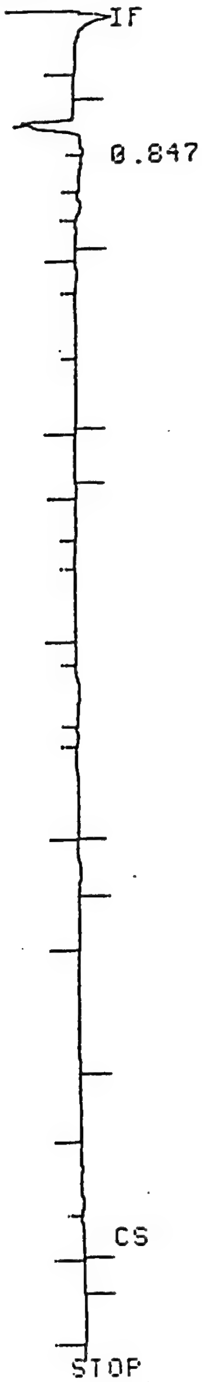
GRP#	ug/L	NAME
1	1.0703E+03	TOTAL XYLENES

RUN # [illegible]

DEFAULT SAMPLE INFORMATION
USE SAMPLE TABLE IN MANUAL RUN [Y/N*]:

ISTD AMT [0.0000E+00]:
SAMPLE AMT [0.0000E+00]:
MUL FACTOR [1.0000E+00]: .25
RECALIBRATION [Y/N*]:
NAME: BLANK-04
REPORT MEMO:

* RUN # 15 OCT 8, 1991 07:16:06
START



Closing signal file B:0363E137.SNC

RUN#   15   OCT 8, 1991 07:16:06

SAMPLE NAME: BLANK-04

SIGNAL FILE: B:Q363E137.BNC

MATHES RECON MULTIMEDIA ANALYSIS

NO CALIB PEAKS FOUND
AREA%

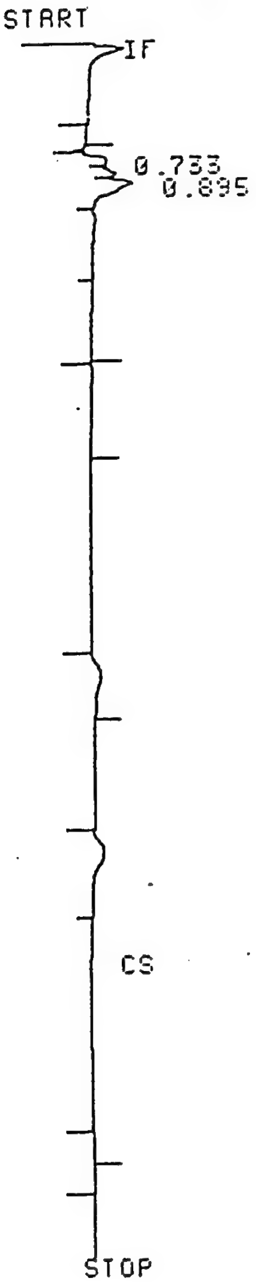
RT	AREA	TYPE	WIDTH	AREA%
.847	10106	BV	.141	25.00000

TOTAL AREA= 10106
MUL FACTOR=2.5000E-01

DEFAULT SAMPLE INFORMATION
USE SAMPLE TABLE IN MANUAL RUN [Y/N*]:

ISTD AMT [0.0000E+00]:
SAMPLE AMT [0.0000E+00]:
MUL FACTOR [2.5000E-01]:
RECALIBRATION [Y/N*]:
NAME: BLANK-05
REPORT MEMO:

* RUN # 18 OCT 8, 1991 08:05:03



Closing signal file B:Q363ECB0.BNC

SAMPLE NAME: BLANK-05

SIGNAL FILE: B:Q363ECB0.BNC

MATHES RECON MULTIMEDIA ANALYSIS

NO CALIB PEAKS FOUND

AREA%

RT	AREA	TYPE	WIDTH	AREA%
.733	2919	BV	.065	6.36169
.895	8552	VV	.098	18.63830

TOTAL AREA= 11471
MUL FACTOR=2.5000E-01

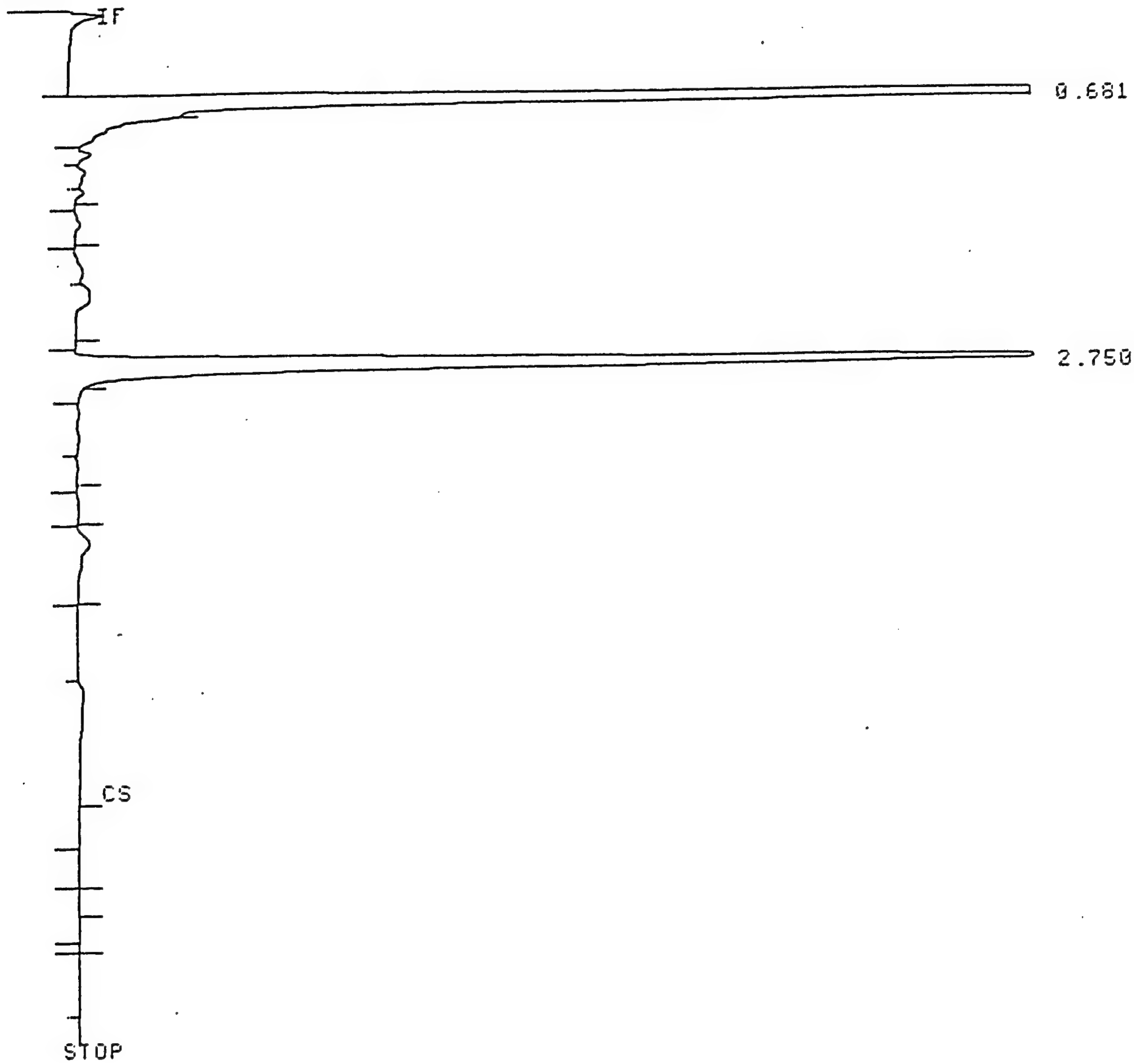
RUN = 18-303

* OP # 7

DEFAULT SAMPLE INFORMATION
USE SAMPLE TABLE IN MANUAL RUN [Y/N*]:

ISTD AMT [0.0000E+00]:
SAMPLE AMT [0.0000E+00]:
MUL FACTOR [2.5000E-01]:
RECALIBRATION [Y/N*]:
NAME: GW-05
REPORT MEMO: PH-05

* RUN # 19 OCT 8, 1991 08:57:47
START



STOP

Closing signal file B:Q363F90C.BNC

RUN # . 19-002

SAMPLE NAME: GW-05
PH-05

SIGNAL FILE: B:Q363F90C.BNC

MATHES RECON MULTIMEDIA ANALYSIS

ESTD-AREA

RT	TYPE	AREA	WIDTH	CAL#	ug/L	NAME
.681	PB	467700	.050		.000	
2.750	PB	193914	.086	3R	.000	INT.STD.

TOTAL AREA= 661614
MUL FACTOR=2.5000E-01

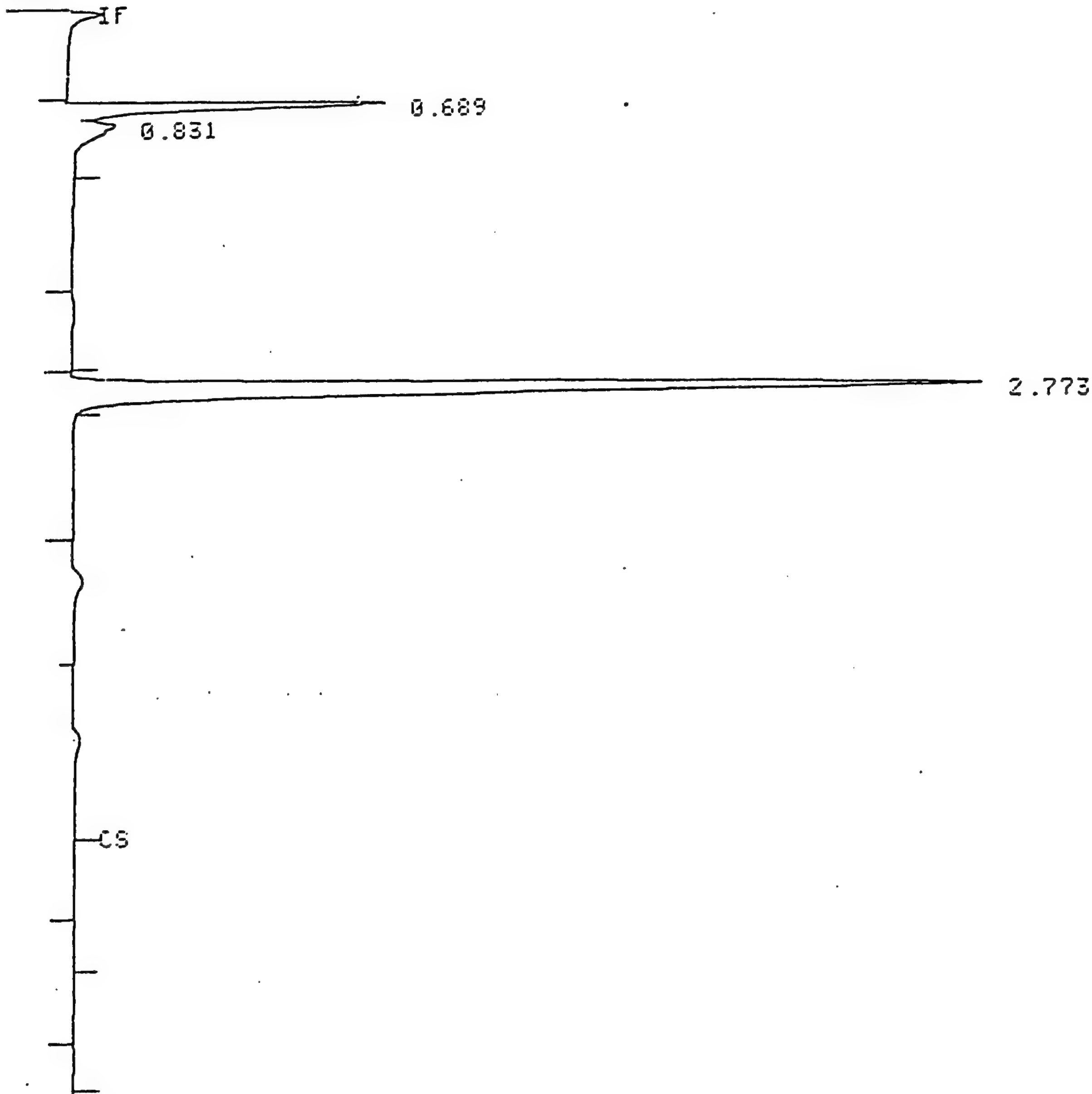
GRP#	ug/L	NAME
1	0.0000E+00	TOTAL XYLENES

+ OP # 7

DEFAULT SAMPLE INFORMATION
USE SAMPLE TABLE IN MANUAL RUN [Y/N*]:

ISTD AMT [0.0000E+00]:
SAMPLE AMT [0.0000E+00]:
MUL FACTOR [2.5000E-01]:
RECALIBRATION [Y/N*]:
NAME: GW-06
REPORT MEMO: PH-06

* RUN # 20 OCT 8, 1991 10:09:39
START



STOP

Closing signal file B:03640964.BNC

RUN =

RUN# 27 OCT 8, 1991 15:43:03

SAMPLE NAME: GW-13
PH-13

SIGNAL FILE: B:Q3645808.BNC

MATHES RECON MULTIMEDIA ANALYSIS

ESTD-AREA

RT	TYPE	AREA	WIDTH	CAL#	ug/L	NAME
.690	PV	166080	.062		.000	
.815	VV	26657	.064		.000	
.944	VV	160558	.072		.000	
1.117	VV	9268	.069		.000	
1.247	VV	174431	.084		.000	
1.403	VV	22550	.064		.000	
1.605	VV	87859	.105		.000	
1.980	VV	88901	.106		.000	
2.179	VB	423715	.095	1	167.764	BENZENE
2.765	PB	230514	.109	5R	.000	INT.STD.
3.131	BV	132817	.100		.000	
3.265	VV	191772	.117		.000	
3.510	VP	6518	.097		.000	
3.758	PP	43936	.131		.000	
4.111	PV	9306	.160		.000	
4.328	VV	7593	.119		.000	
5.568	PV	17465	.363		.000	
7.649	PB	41234	.205	~~6~~	~~14.368~~	~~M&P XYLENE~~
8.022	BB	1329	.049		.000	

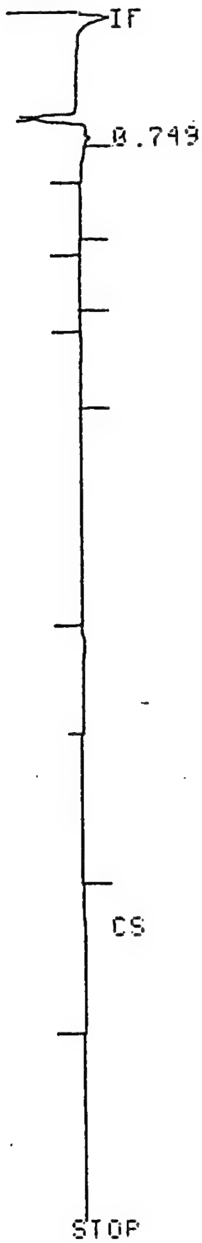
TOTAL AREA=1842503
MUL FACTOR=2.5000E-01

GRP#	ug/L	NAME
1	1.4368E+01	TOTAL XYLENES

DEFAULT SAMPLE INFORMATION
USE SAMPLE TABLE IN MANUAL RUN [Y/N*]:

ISTD AMT [0.0000E+00]:
SAMPLE AMT [0.0000E+00]:
MUL FACTOR [2.5000E-01]:
RECALIBRATION [Y/N*]:
NAME: BLANK-06
REPORT MEMO:

* RUN # 28 OCT 8, 1991 16:00:04
START



Closing signal file B:Q3645C05.BNC

RUN = [illegible]

SAMPLE NAME: BLANK-06

SIGNAL FILE: B:Q3645C05.BNC

MATHES RECON MULTIMEDIA ANALYSIS

NO CALIB PEAKS FOUND
AREA%

RT	AREA	TYPE	WIDTH	AREA%
.749	5347	BB	.096	25.00000

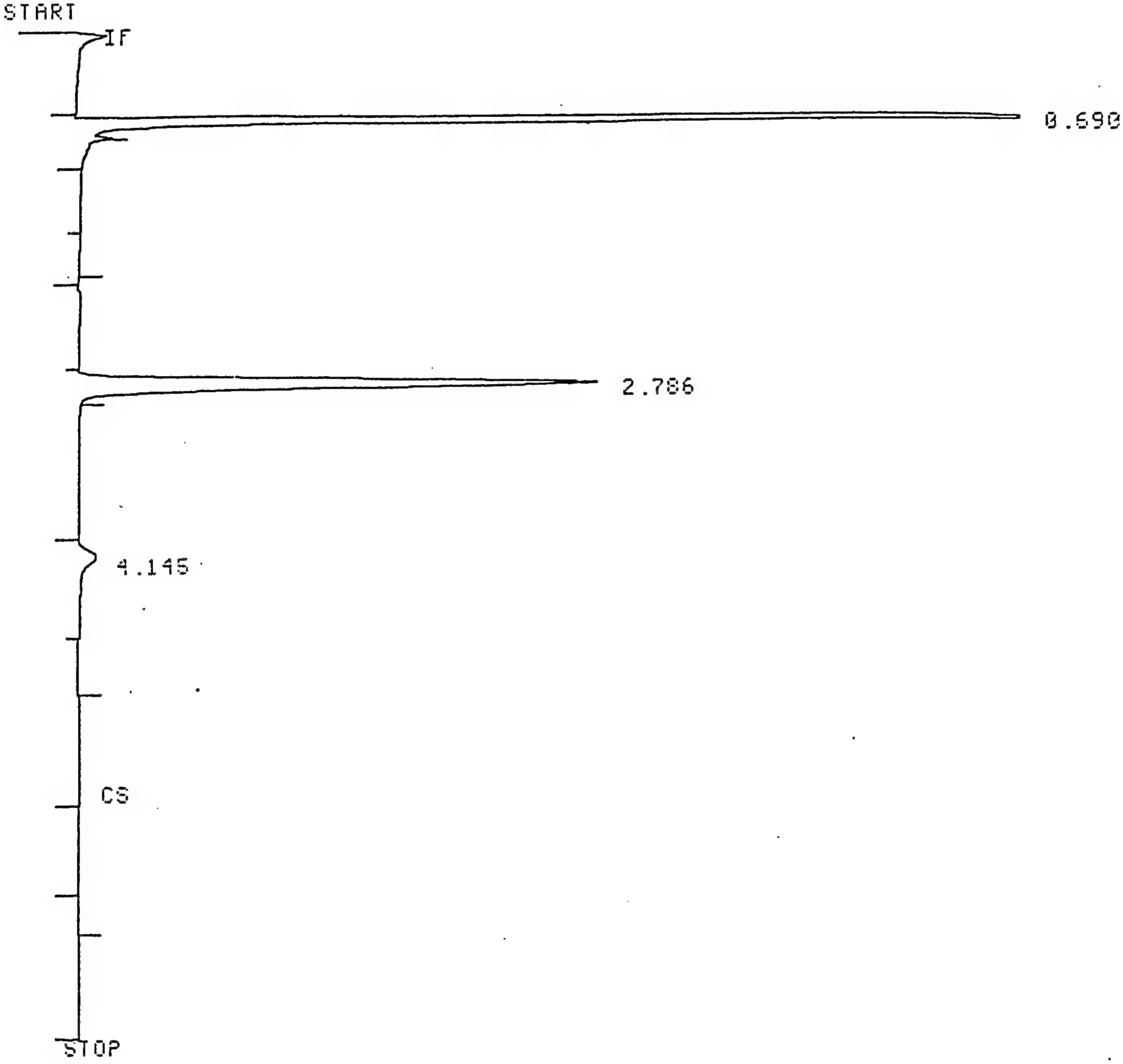
TOTAL AREA= 5347
MUL FACTOR=2.5000E-01

\+ OP # 7

DEFAULT SAMPLE INFORMATION
USE SAMPLE TABLE IN MANUAL RUN [Y/N*]:

ISTD AMT [0.0000E+00]:
SAMPLE AMT [0.0000E+00]:
MUL FACTOR [2.5000E-01]:
RECALIBRATION [Y/N*]:
NAME: GW-14
REPORT MEMO: PH-14

* RUN # 29 OCT 8, 1991 16:29:02



Closing signal file B:Q3646ICF.BNC

RUN # 29-002

SAMPLE NAME: GW-14
PH-14

SIGNAL FILE: B:Q36462CF.BNC

MATHES RECON MULTIMEDIA ANALYSIS

ESTD-AREA

RT	TYPE	AREA	WIDTH	CAL#	ug/L	NAME
.690	PB	118099	.045		.000	
2.786	PB	87224	.082	3R	.000	INT.STD.
4.145	BP	5427	.143		.000	

TOTAL AREA= 210750
MUL FACTOR=2.5000E-01

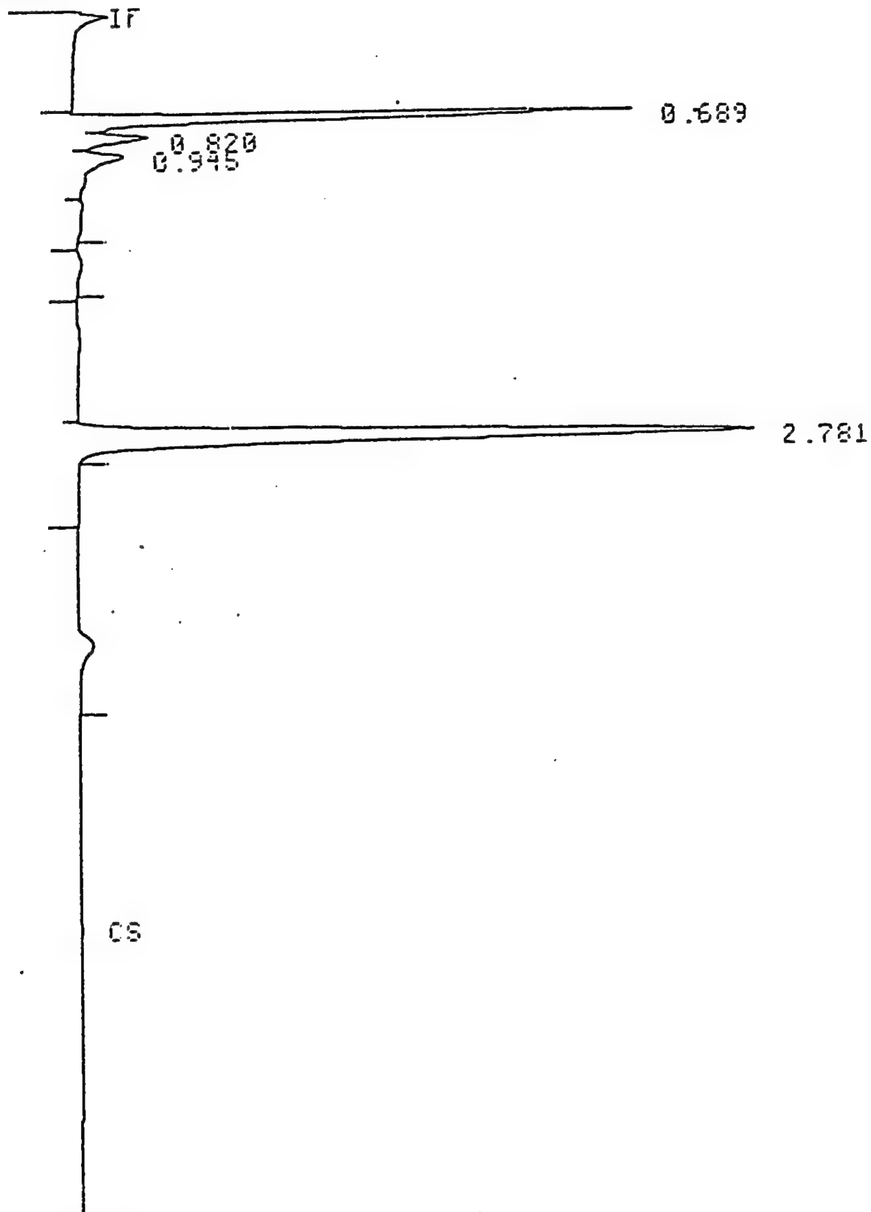
GRP#	ug/L	NAME
1	0.0000E+00	TOTAL XYLENES

+ OP # 7

DEFAULT SAMPLE INFORMATION
USE SAMPLE TABLE IN MANUAL RUN [Y/N*]:

ISTD AMT [0.0000E+00]:
SAMPLE AMT [0.0000E+00]:
MUL FACTOR [2.5000E-01]:
RECALIBRATION [Y/N*]:
NAME: GW-14D
REPORT MEMO: PH-14

* RUN # 30 OCT 8, 1991 16:41:30
START



STOP

Closing signal file B:Q36465BC.BNC

RUN = 7 032

SAMPLE NAME: GW-14D
PH-14

SIGNAL FILE: B:Q36465BC.BNC

MATHES RECON MULTIMEDIA ANALYSIS

ESTD-AREA

RT	TYPE	AREA	WIDTH	CAL#	ug/L	NAME
.689	PV	45786	.048		.000	
.820	VV	8905	.067		.000	
.945	VV	9866	.107		.000	
2.781	PB	98259	.085	3R	.000	INT.STD.

TOTAL AREA= 162816
MUL FACTOR=2.5000E-01

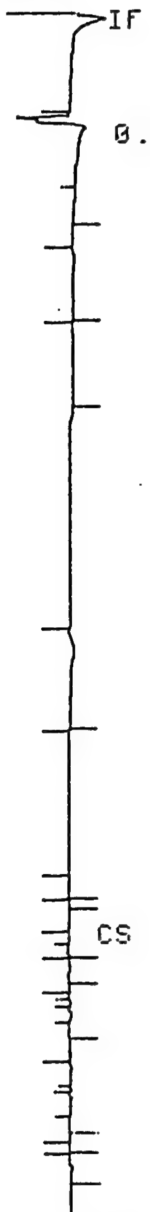
GRP#	ug/L	NAME
1	0.0000E+00	TOTAL XYLENES

+ OP # 7

DEFAULT SAMPLE INFORMATION
USE SAMPLE TABLE IN MANUAL RUN [Y/N*]:

ISTD AMT [0.0000E+00]:
SAMPLE AMT [0.0000E+00]:
MUL FACTOR [2.5000E-01]:
RECALIBRATION [Y/N*]:
NAME: BLANK-07
REPORT MEMO:

* RUN # 31 OCT 8, 1991 16:54:08
START



STOP

Closing signal file B:03646881.BNC

SAMPLE NAME: BLANK-07

SIGNAL FILE: B:Q36468B1.BNC

MATHES RECON MULTIMEDIA ANALYSIS

NO CALIB PEAKS FOUND
AREA%

RT	AREA	TYPE	WIDTH	AREA%
.740	1951	PV	.061	25.00000

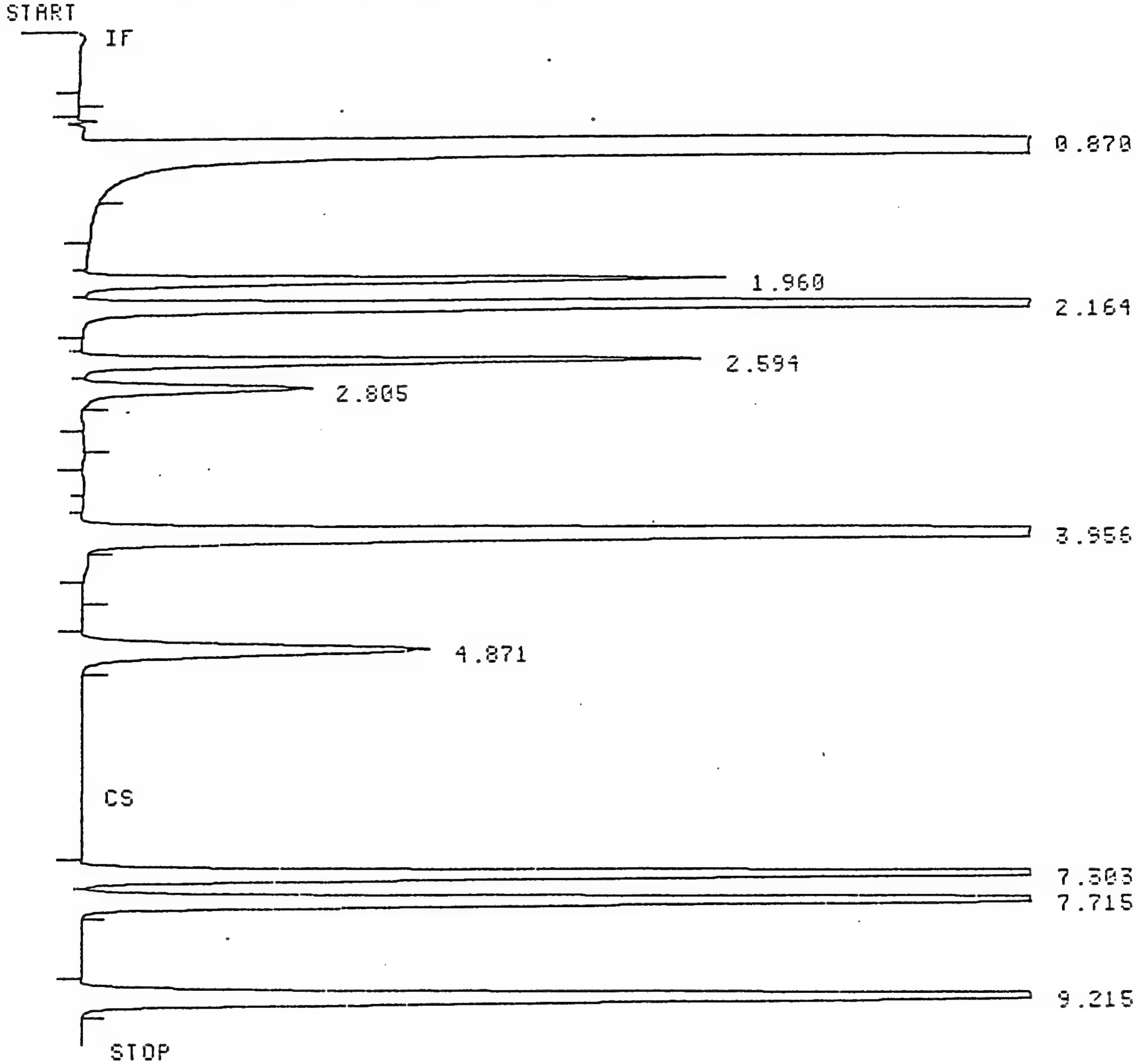
TOTAL AREA= 1951
MUL FACTOR=2.5000E-01

+ OP # 7

DEFAULT SAMPLE INFORMATION
USE SAMPLE TABLE IN MANUAL RUN [Y/N*]:

ISTD AMT [0.0000E+00]:
SAMPLE AMT [0.0000E+00]:
MUL FACTOR [2.5000E-01]: 1
RECALIBRATION [Y/N*]:
NAME: RT-02
REPORT MEMO:

* RUN # 32 OCT 8, 1991 17:05:24



Closing signal file B:03646B55.BNC

RUN# 32 OCT 8, 1991 17:05:24

SAMPLE NAME: RT-02

SIGNAL FILE: B:Q3646B55.BNC

MATHES RECON MULTIMEDIA ANALYSIS

ESTD-AREA

RT	TYPE	AREA	WIDTH	CAL#	ug/L	NAME
.870	SBB	32647792	.031		.000	
1.960	PP	74315	.057		.000	
2.164	PB	316195	.052	1	500.775	BENZENE
2.594	PV	74970	.059	2	506.960	TCE
2.805	VB	35025	.075	3R	.000	INT.STD.
3.956	PB	325717	.082	4	504.934	TOLUENE
4.871	BB	70946	.100		.000	
7.303	PV	375398	.137	5	540.314	ETHYLBENZENE
7.715	VB	397295	.143	6	553.761	M&P-XYLENE
9.215	PB	411078	.168	7	554.828	O-XYLENE

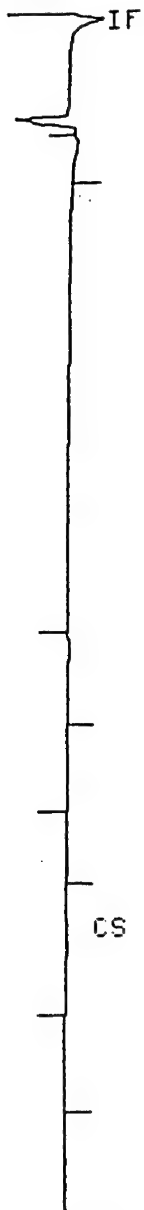
TOTAL AREA=3.4729E+07
MUL FACTOR=1.0000E+00

GRP#	ug/L	NAME
1	1.1086E+03	TOTAL XYLENES

DEFAULT SAMPLE INFORMATION
USE SAMPLE TABLE IN MANUAL RUN [Y/N+]:

ISTD AMT [0.0000E+00]:
SAMPLE AMT [0.0000E+00]:
MUL FACTOR [1.0000E+00]: .25
RECALIBRATION [Y/N*]:
NAME: BLANK-08
REPORT MEMO: '

* RUN # 33 OCT 9, 1991 07:13:21
START



STOP

Closing signal file B:03653212.BNC

RUN#   33   OCT 9, 1991 07:13:21

SAMPLE NAME: BLANK-08

SIGNAL FILE: B:Q3653212.BNC

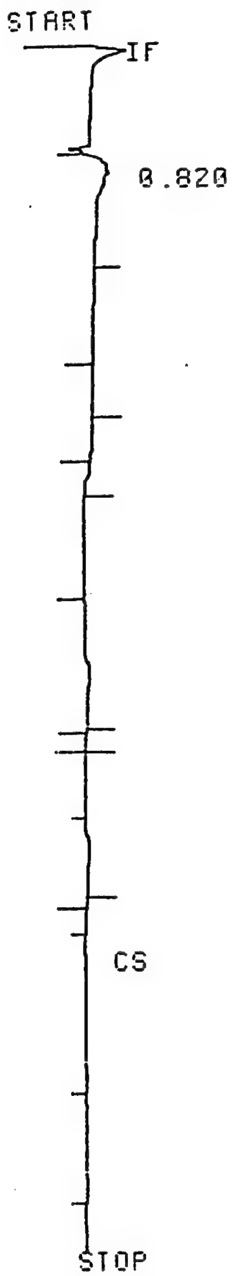
MATHES RECON MULTIMEDIA ANALYSIS

NO RUN PEAKS STORED

DEFAULT SAMPLE INFORMATION
USE SAMPLE TABLE IN MANUAL RUN [Y/N*]:

ISTD AMT [0.0000E+00]:
SAMPLE AMT [0.0000E+00]:
MUL FACTOR [2.5000E-01]:
RECALIBRATION [Y/N*]:
NAME: BLANK-009
REPORT MEMO:

* RUN # 35 OCT 9, 1991 08:11:40



Closing signal file B:03653FBD.BNC

RUN# 35 OCT 9, 1991 08:11:40

SAMPLE NAME: BLANK-009

SIGNAL FILE: B:Q3653FBD.BNC

MATHES RECON MULTIMEDIA ANALYSIS

NO CALIB PEAKS FOUND

AREA%

RT	AREA	TYPE	WIDTH	AREA%
.820	10480	BB	.257	25.00000

TOTAL AREA= 10480
MUL FACTOR=2.5000E-01

RUN#   20   OCT 8, 1991   10:09:39

SAMPLE NAME: GW-06
PH-06

SIGNAL FILE: B:Q36409E4.BNC

MATHES RECON MULTIMEDIA ANALYSIS

ESTD-AREA

RT	TYPE	AREA	WIDTH	CAL#	ug/L	NAME
.689	PV	36673	.062		.000	
.831	VB	12709	.136		.000	
2.773	PB	149907	.088	3R	.000	INT.STD.

TOTAL AREA= 199289
MUL FACTOR=2.5000E-01

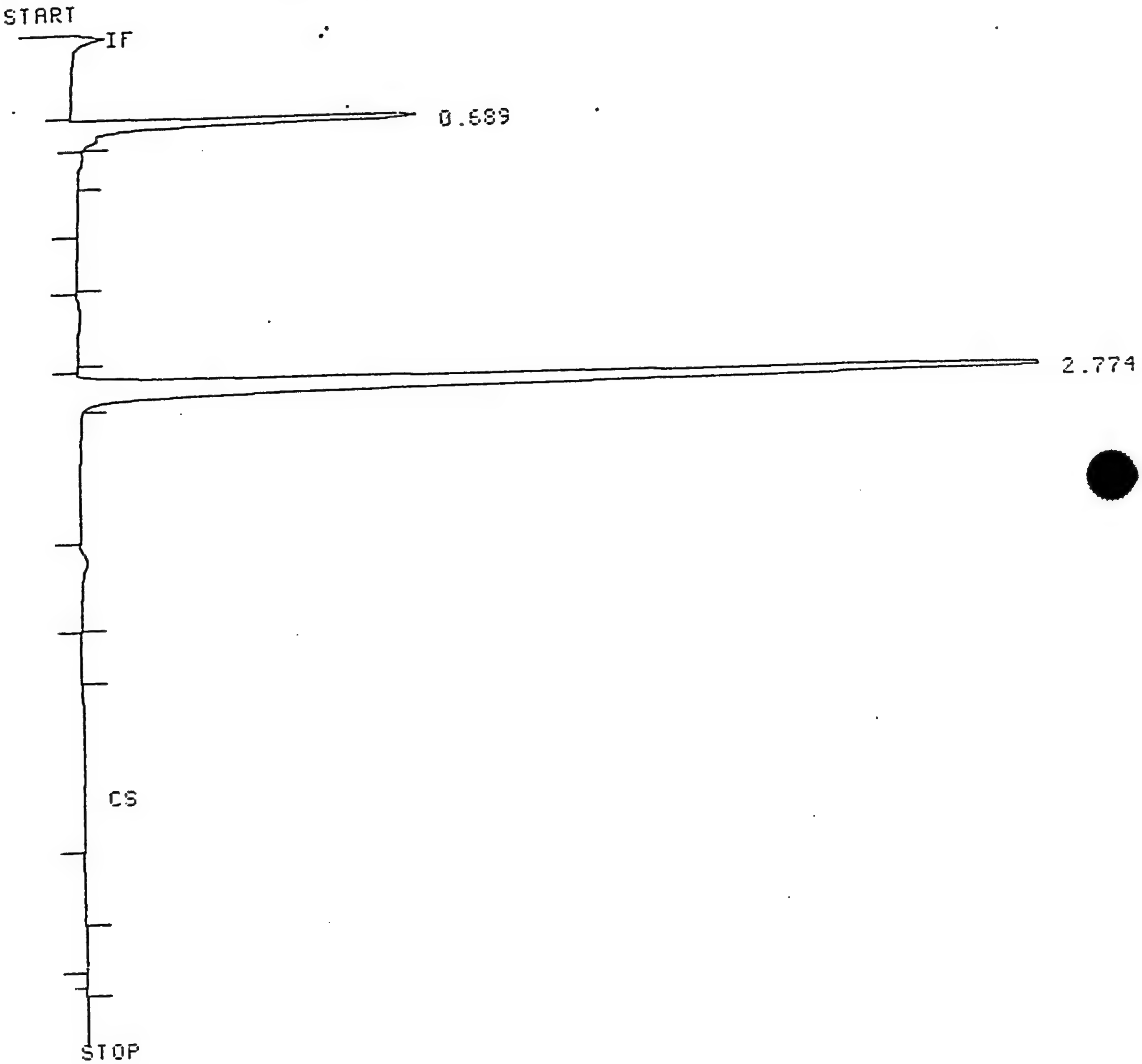
GRP#	ug/L	NAME
1	0.0000E+00	TOTAL XYLENES

\+ OP # 7

DEFAULT SAMPLE INFORMATION
USE SAMPLE TABLE IN MANUAL RUN [Y/N*]:

ISTD AMT [0.0000E+00]:
SAMPLE AMT [0.0000E+00]:
MUL FACTOR [2.5000E-01]:
RECALIBRATION [Y/N*]:
NAME: GU-07
REPORT MEMO: PH-07

* RUN # 21 OCT 8, 1991 10:33:26



Closing signal file B:Q3640F77 SHC

RUN# 21 OCT 8, 1991 10:33:26

SAMPLE NAME: EJ-07
FH-07

SIGNAL FILE: B:Q3640F77.BNC

MATHES RECON MULTIMEDIA ANALYSIS

ESTD-AREA

RT	TYPE	AREA	WIDTH	CAL#	ug/L	NAME
.689	PB	43620	.063		.000	
2.774	PB	189196	.085	3R	.000	INT.STD.

TOTAL AREA= 232816
MUL FACTOR=2.5000E-01

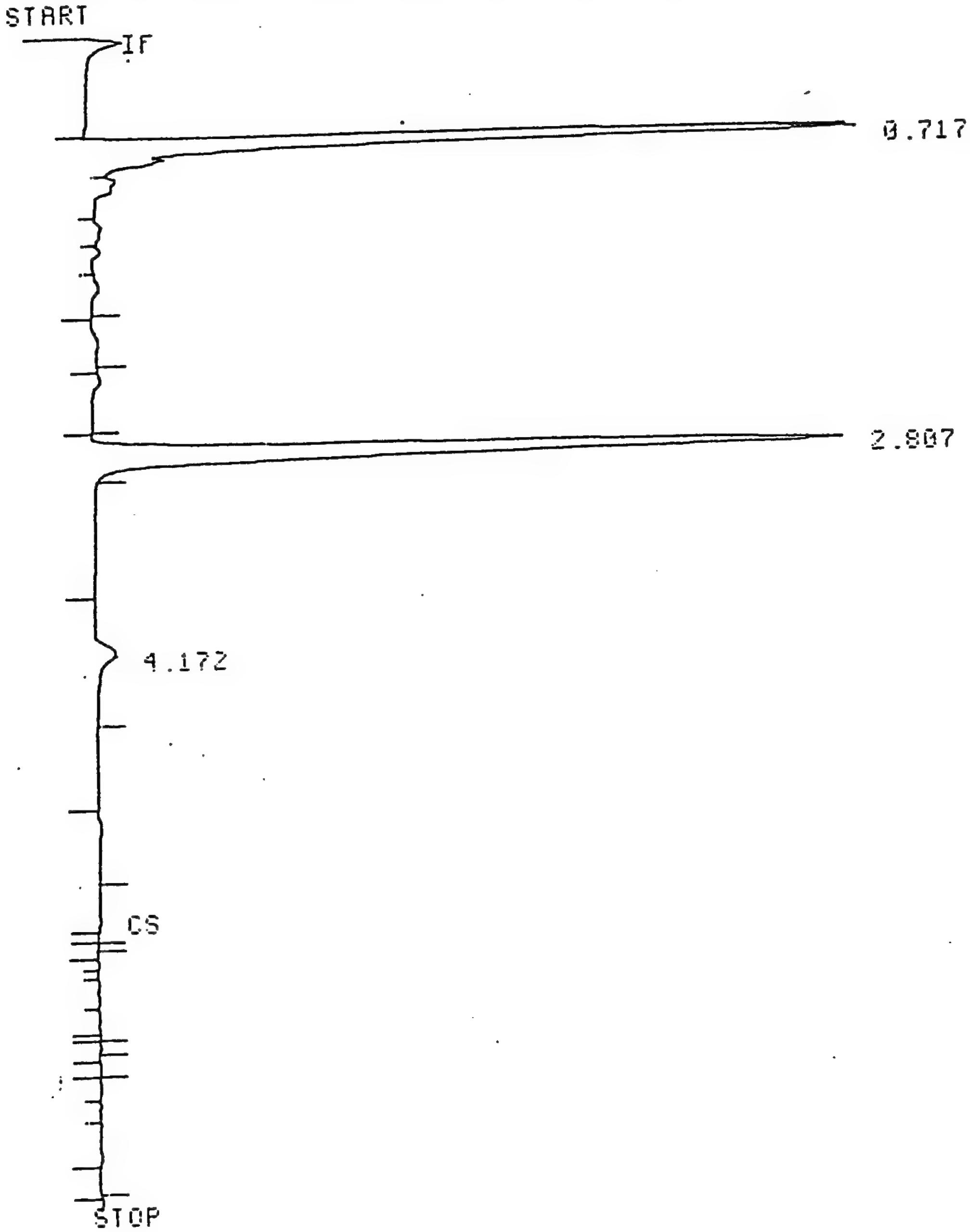
GRP#	ug/L	NAME
1	0.0000E+00	TOTAL XYLENES

\+ OP # 7

DEFAULT SAMPLE INFORMATION
USE SAMPLE TABLE IN MANUAL RUN [Y/N*]:

ISTD AMT [0.0000E+00]:
SAMPLE AMT [0.0000E+00]:
MUL FACTOR [2.5000E-01]:
RECALIBRATION [Y/N*]:
NAME: GW-08
REPORT MEMO: FH-08

* RUN # 22 OCT 8, 1991 12:04:02



Closing signal file B:03642483.BNC

NAME: GW-08

L FILE: B:Q3642483.BHC

HES RECON MULTIMEDIA ANALYSIS

,TO-AREA

RT	TYPE	AREA	WIDTH	CAL#	ug/L	NAME
.717	BV	99359	.072		.000	
2.807	PB	114726	.087	3R	.000	INT.STD.
4.172	PB	6823	.174		.000	

TOTAL AREA= 220908
MUL FACTOR=2.5000E-01

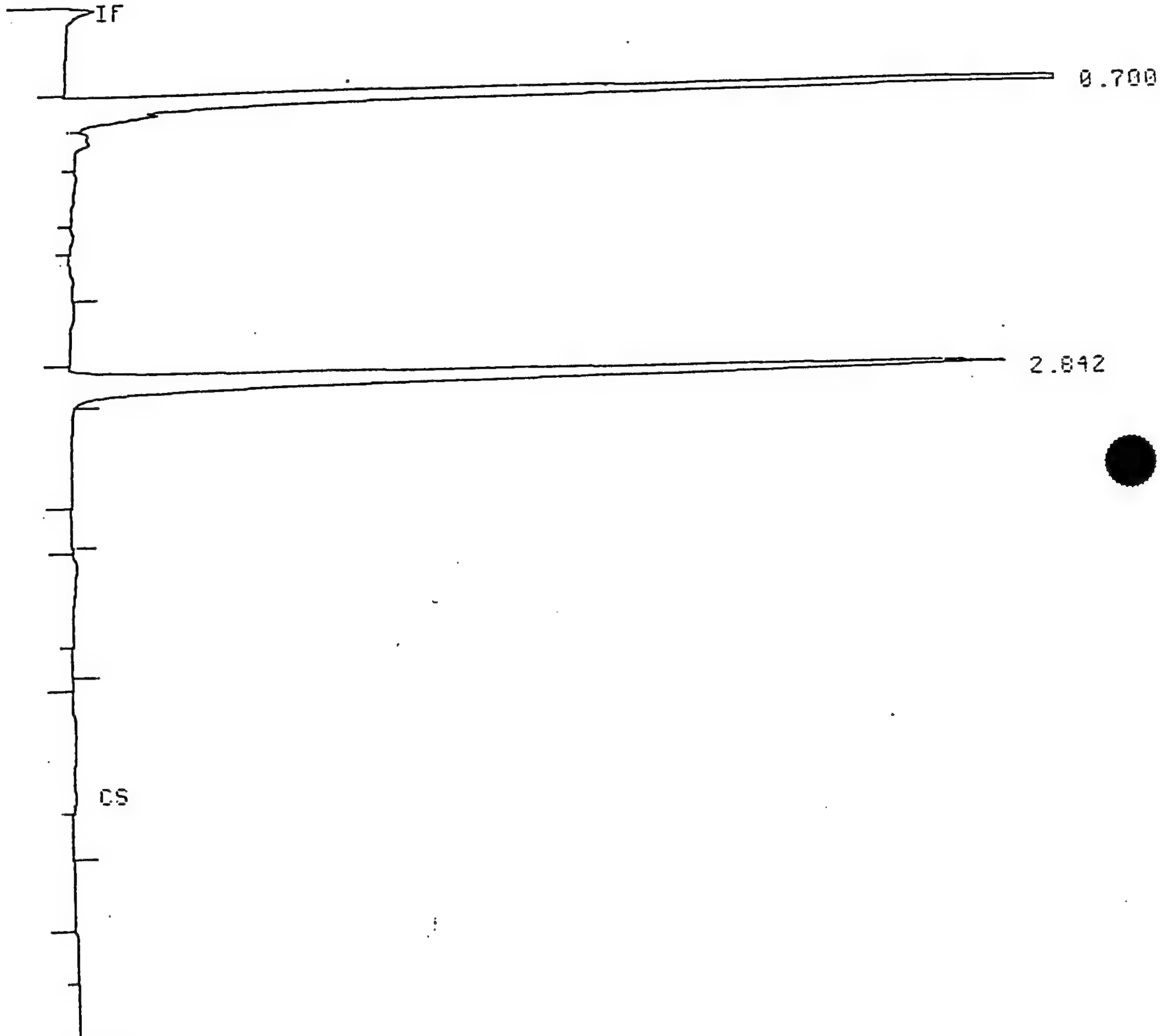
GRP#	ug/L	NAME
1	0.0000E+00	TOTAL XYLENES

* OP # 7

DEFAULT SAMPLE INFORMATION
USE SAMPLE TABLE IN MANUAL RUN [Y/N*]:

ISTD AMT [0.0000E+00]:
SAMPLE AMT [0.0000E+00]:
MUL FACTOR [2.5000E-01]:
RECALIBRATION [Y/N*]:
NAME: GW-09
REPORT MEMO: PH-09

* RUN # 23 OCT 8, 1991 13:40:10
START



STOP

Closing signal file B:0364383C [illegible]

RUN # 23-001

SAMPLE NAME: GW-09
PH-09

SIGNAL FILE: B:Q3643B3C.BNC

MATHES RECON MULTIMEDIA ANALYSIS

ESTD-AREA

RT	TYPE	AREA	WIDTH	CAL#	ug/L	NAME
.700	PV	175726	.063		.000	
2.842	PB	164258	.090	3R	.000	INT.STD.

TOTAL AREA= 339984
MUL FACTOR=2.5000E-01

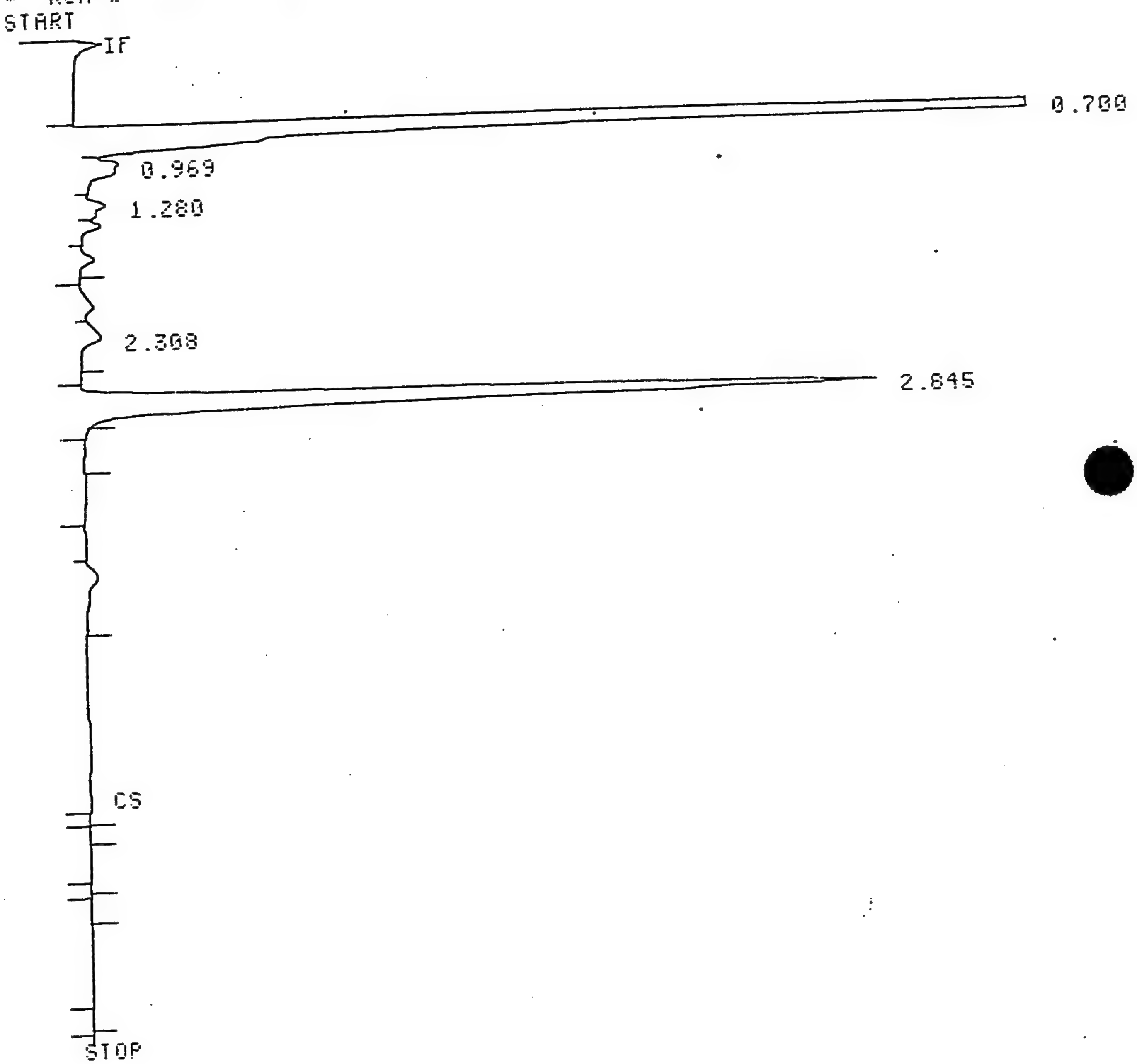
GRP#	ug/L	NAME
1	0.0000E+00	TOTAL XYLENES

+ OP # 7

DEFAULT SAMPLE INFORMATION
USE SAMPLE TABLE IN MANUAL RUN [Y/N*]:

ISTD AMT [0.0000E+00]:
SAMPLE AMT [0.0000E+00]:
MUL FACTOR [2.5000E-01]:
RECALIBRATION [Y/N*]:
NAME: GW-10
REPORT MEMO: PH-10

* RUN # 24 OCT 8, 1991 14:12:57



Closing signal file B:Q36442EA.BNC

RUN# 24 OCT 8, 1991 14:12:57

SAMPLE NAME: GW-10
PH-10

SIGNAL FILE: B:Q36442EA.BNC

MATHES RECON MULTIMEDIA ANALYSIS

ESTD-AREA

RT	TYPE	AREA	WIDTH	CAL#	ug/L	NAME
.700	PB	489862	.063		.000	
.969	PP	4949	.108		.000	
1.280	PV	4523	.104		.000	
2.308	VB	7467	.161		.000	
2.845	PB	148413	.092	3R	.000	INT.STD.

TOTAL AREA= 655214
MUL FACTOR=2.5000E-01

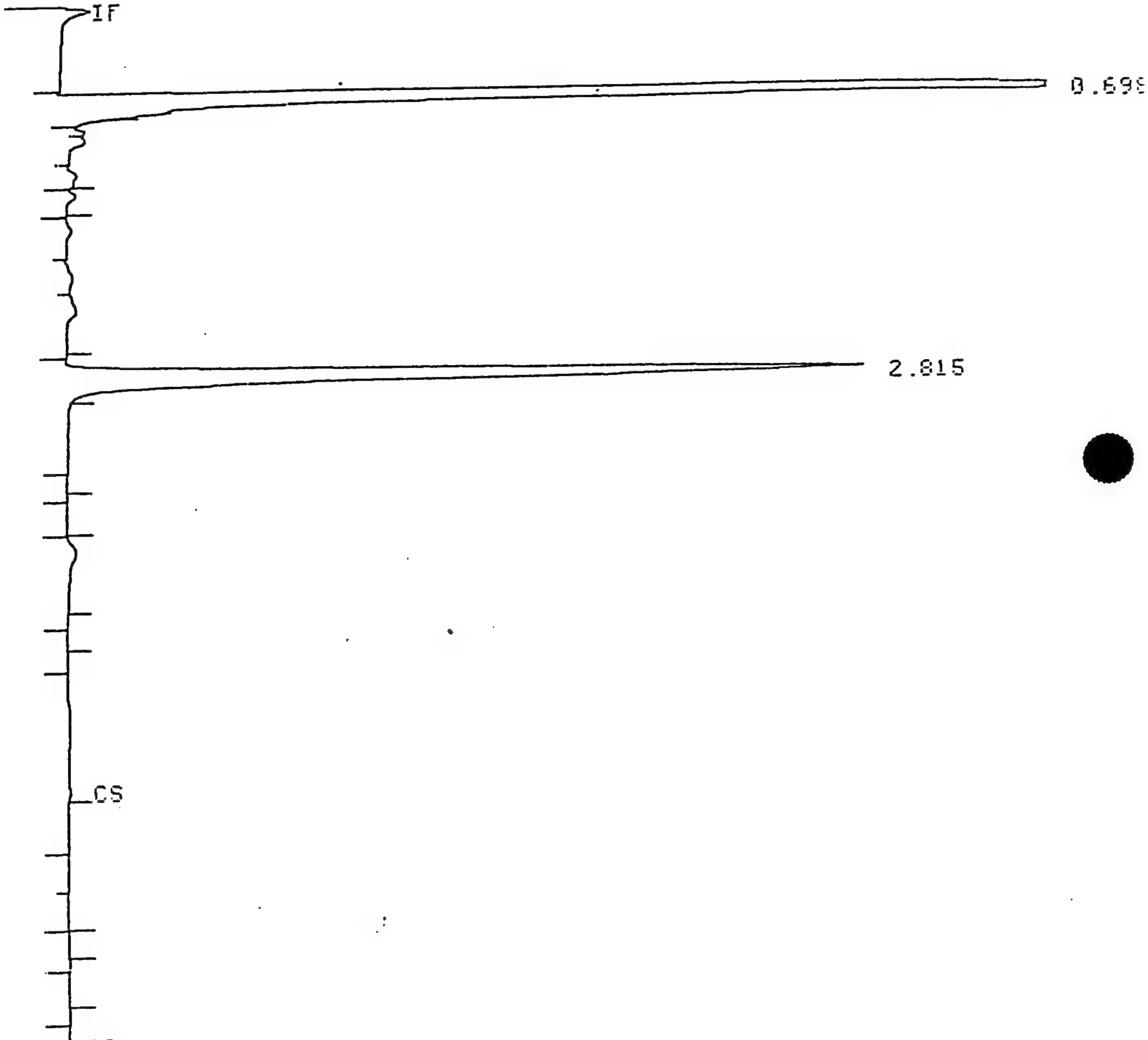
GRP#	ug/L	NAME
1	0.0000E+00	TOTAL XYLENES

* OP # 7

DEFAULT SAMPLE INFORMATION
USE SAMPLE TABLE IN MANUAL RUN [Y/N*]:

ISTD AMT [0.0000E+00]:
SAMPLE AMT [0.0000E+00]:
MUL FACTOR [2.5000E-01]:
RECALIBRATION [Y/N*]:
NAME: GW-11
REPORT MEMO: PH-11

* RUN # 25 OCT 8, 1991 14:41:32
START



STOP

Closing signal file B:Q3644990 BNC

''# 25 OCT 8, 1991 14:41:32

_E NAME: GW-11
1

GNAL FILE: B:Q3644990.BNC

ATHES RECON MULTIMEDIA ANALYSIS

ESTD-AREA

RT	TYPE	AREA	WIDTH	CAL#	ug/L	NAME
.698	PB	321323	.058		.000	
2.815	PB	139508	.089.	3R	.000	INT.STD.

TOTAL AREA= 460831
MUL FACTOR=2.5000E-01

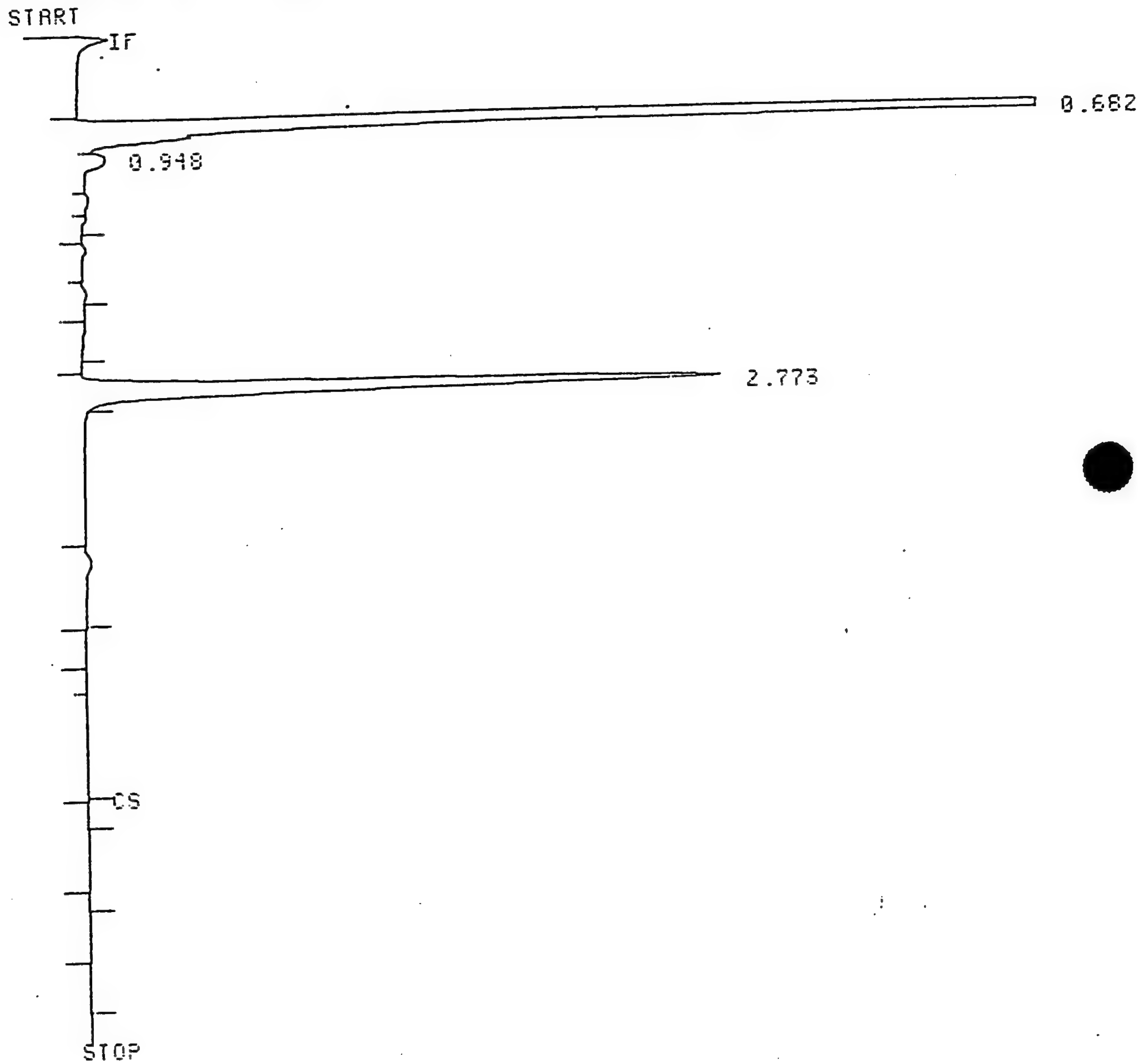
GRP#	ug/L	NAME
1	0.0000E+00	TOTAL XYLENES

* OP # 7

DEFAULT SAMPLE INFORMATION
USE SAMPLE TABLE IN MANUAL RUN [Y/N*]:

ISTD AMT [0.0000E+00]:
SAMPLE AMT [0.0000E+00]:
MUL FACTOR [2.5000E-01]:
RECALIBRATION [Y/N*]:
NAME: GW-12
REPORT MEMO: PH-12

* RUN # 26 OCT 8, 1991 15:12:02



Closing signal file B:03645003.BNC

RUN# 26 OCT 8, 1991 15:12:02

SAMPLE NAME: GW-12
PH-12

SIGNAL FILE: B:Q36450C3.BNC

MATHES RECON MULTIMEDIA ANALYSIS

ESTD-AREA

RT	TYPE	AREA	WIDTH	CAL#	ug/L	NAME
.682	BV	303820	.061		.000	
.948	VV	7469	.132		.000	
2.773	PB	113302	.088	3R	.000	INT.STD.

TOTAL AREA= 424591
MUL FACTOR=2.5000E-01

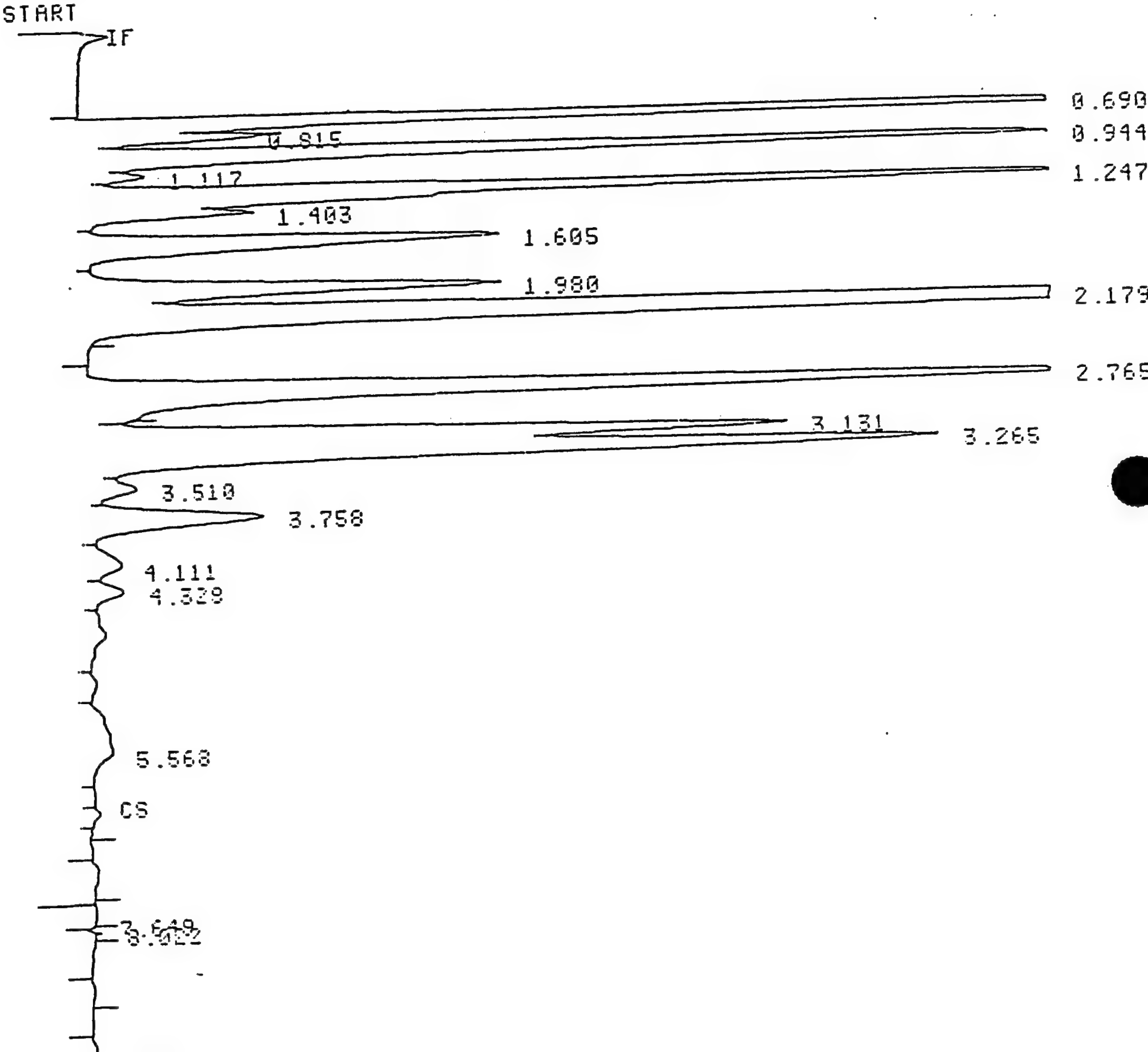
GRP#	ug/L	NAME
1	0.0000E+00	TOTAL XYLENES

\+ OP # 7

DEFAULT SAMPLE INFORMATION
USE SAMPLE TABLE IN MANUAL RUN [Y/N*]:

ISTD AMT [0.0000E+00]:
SAMPLE AMT [0.0000E+00]:
MUL FACTOR [2.5000E-01]:
RECALIBRATION [Y/N*]:
NAME: GW-13
REPORT MEMO: PH-13

* RUN # 27 OCT 8, 1991 15:43:03
START



STOP

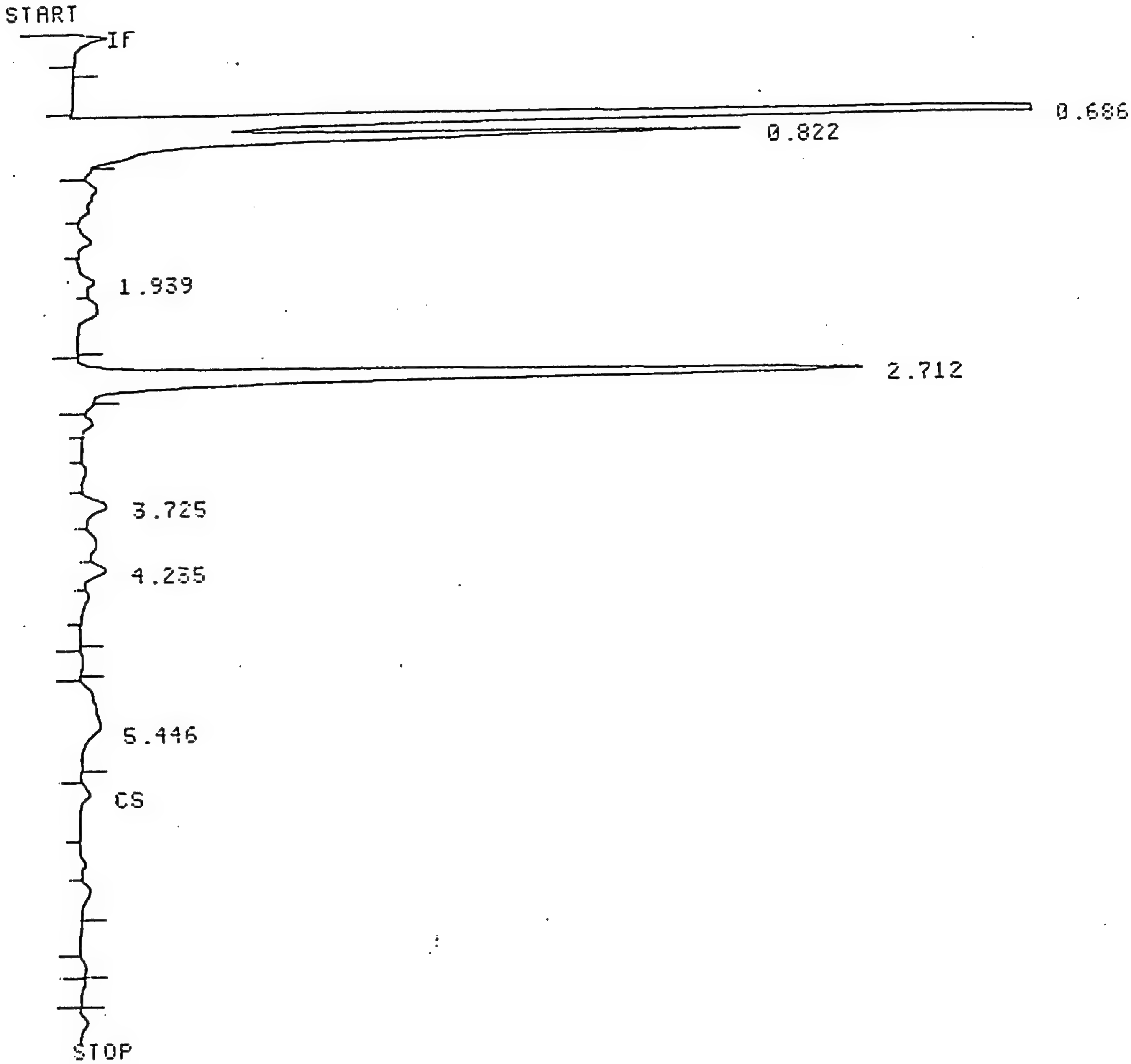
Closing signal file B:Q3645803.BNC

* OP # 7

DEFAULT SAMPLE INFORMATION
USE SAMPLE TABLE IN MANUAL RUN [Y/N*]:

ISTD AMT [0.0000E+00]:
SAMPLE AMT [0.0000E+00]:
MUL FACTOR [2.5000E-01]:
RECALIBRATION [Y/N*]:
NAME: GGW-15
REPORT MEMO: PH-06

* RUN # 36 OCT 9, 1991 09:05:26



Closing signal file B:Q3654C58.BNC

RUN# 56 OCT 9, 1991 09:05:26

SAMPLE NAME: GGW-15
PH-06

SIGNAL FILE: B:03654C58.BNC

MATHES RECON MULTIMEDIA ANALYSIS

NO CALIB PEAKS FOUND
AREA%

RT	AREA	TYPE	WIDTH	AREA%
.686	172472	PV	.075	9.73272
.822	96464	VB	.071	5.44354
1.939	4312	PV	.118	.24333
2.712	141915	PB	.090	8.00836
3.725	7100	PV	.129	.40066
4.235	6699	VV	.127	.37803
5.445	14059	BB	.338	.79336

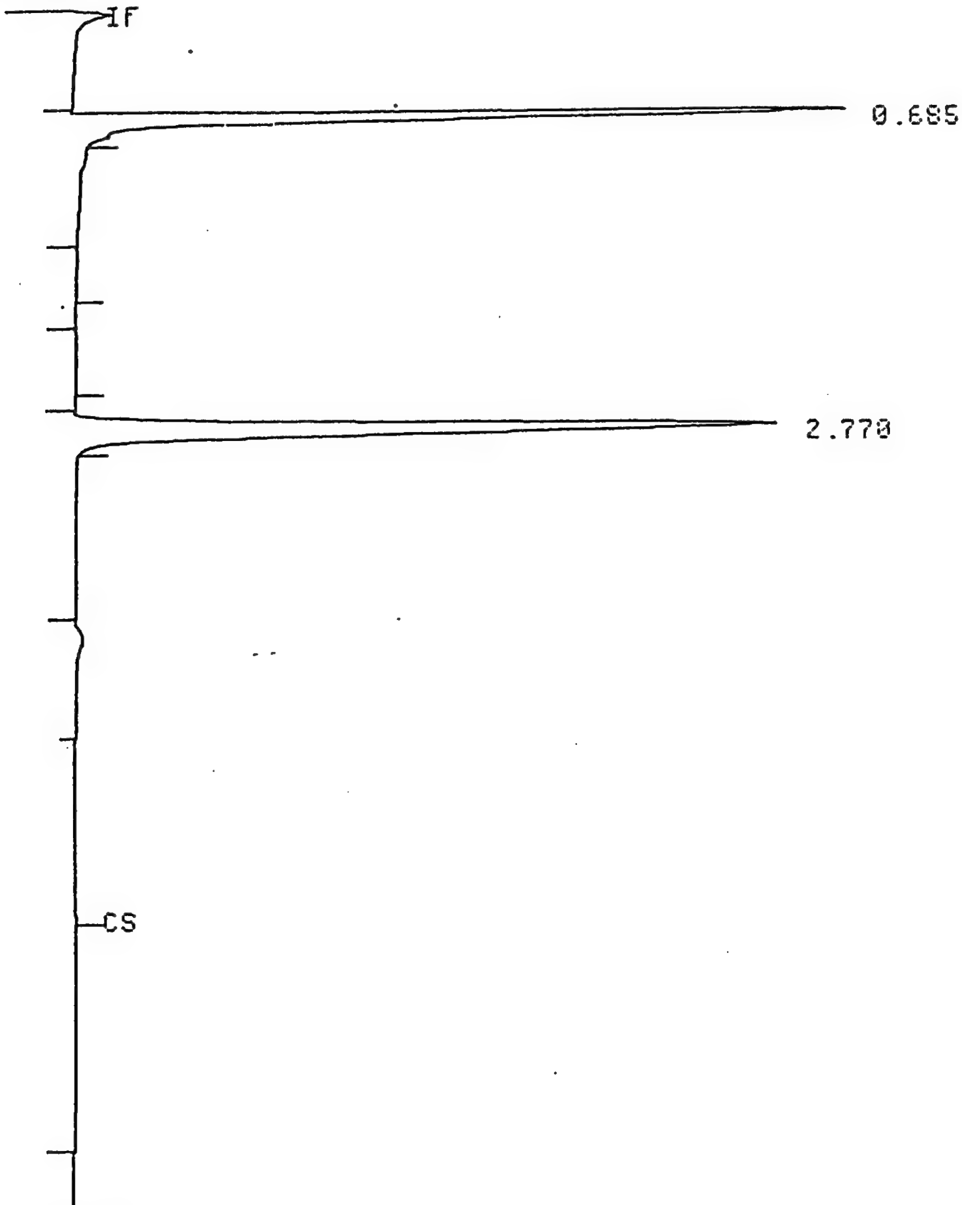
TOTAL AREA= 443021
MUL FACTOR=2.5000E-01

* OF # 7

DEFAULT SAMPLE INFORMATION
USE SAMPLE TABLE IN MANUAL RUN [Y/N*]:

ISTD AMT [0.0000E+00]:
SAMPLE AMT [0.0000E+00]:
MUL FACTOR [2.5000E-01]:
RECALIBRATION [Y/N*]:
NAME: GW-16
REPORT MEMO: PH-06

* RUN # 37 OCT 9, 1991 09:30:44
START



STOP

Closing signal file B:Q3655246.BNC

RUN# 37 OCT 9, 1991 09:30:44

SAMPLE NAME: GW-16
PH-06

SIGNAL FILE: B:Q3655246.BNC

MATHES RECON MULTIMEDIA ANALYSIS

ESTD-AREA

RT	TYPE	AREA	WIDTH	CAL#	ug/L	NAME
.685	PB	78113	.059		.000	
2.770	PB	104623	.087	3R	.000	INT. STD.

TOTAL AREA= 182736
MUL FACTOR=2.5000E-01

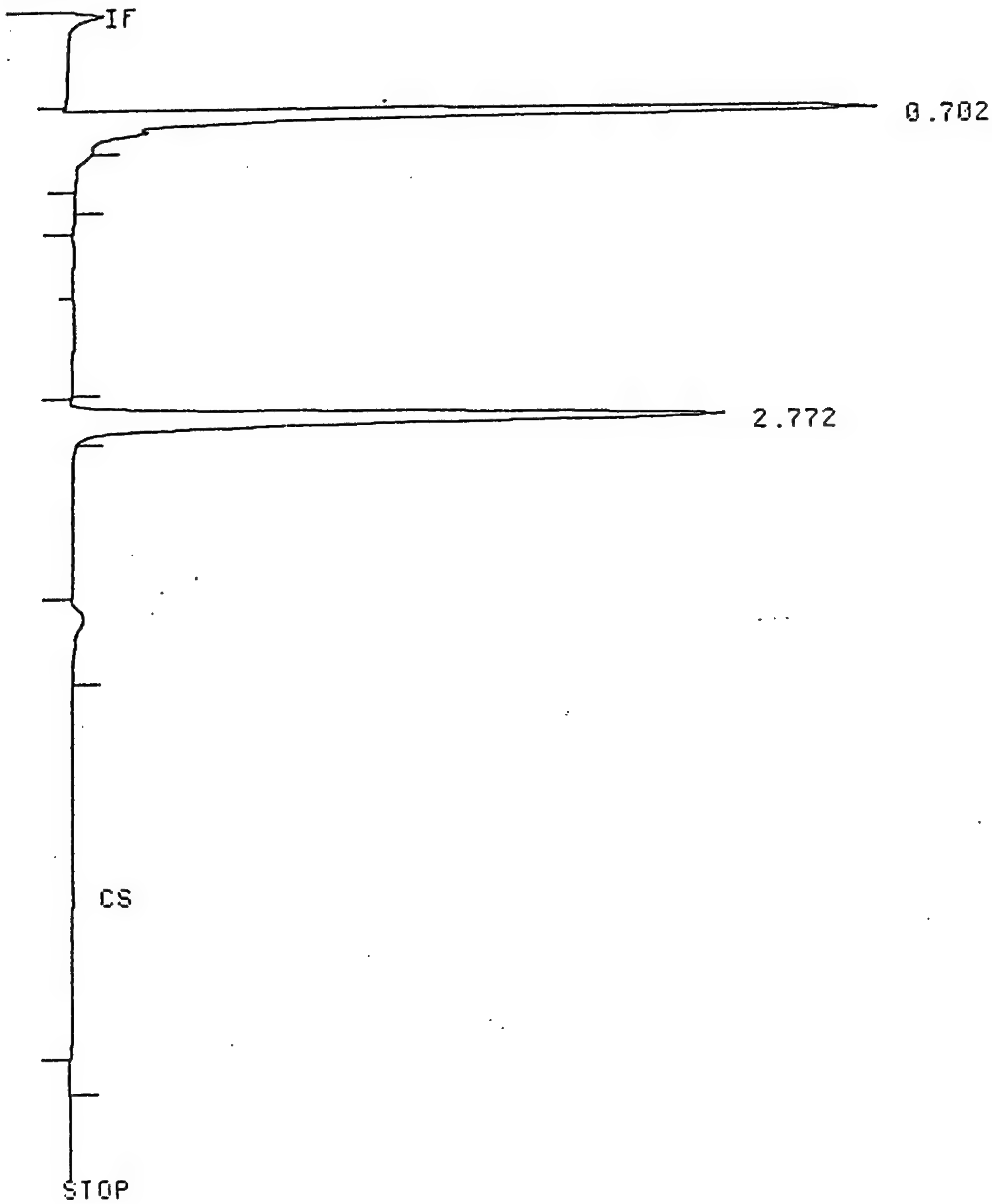
GRP#	ug/L	NAME
1	0.0000E+00	TOTAL XYLENES

* OP # 7

DEFAULT SAMPLE INFORMATION
USE SAMPLE TABLE IN MANUAL RUN [Y/N*]:

ISTD AMT [0.0000E+00]:
SAMPLE AMT [0.0000E+00]:
MUL FACTOR [2.5000E-01]:
RECALIBRATION [Y/N*]:
NAME: GW-17
REPORT MEMO: PH-06

* RUN # 38 OCT 9, 1991 09:50:45
START



Closing signal file B:Q36556F6.BNC

RUN # 38-002

RUN#   38   OCT 9, 1991   09:50:45

SAMPLE NAME: GW-17
PH-05

SIGNAL FILE: B:Q36556F6.BNC

MATHES RECON MULTIMEDIA ANALYSIS

ESTD-AREA

RT	TYPE	AREA	WIDTH	CAL#	ug/L	NAME
.702	PB	106548	.075		.000	
2.772	PB	101910	.089	3R	.000	INT. STD.

TOTAL AREA= 208458
MUL FACTOR=2.5000E-01

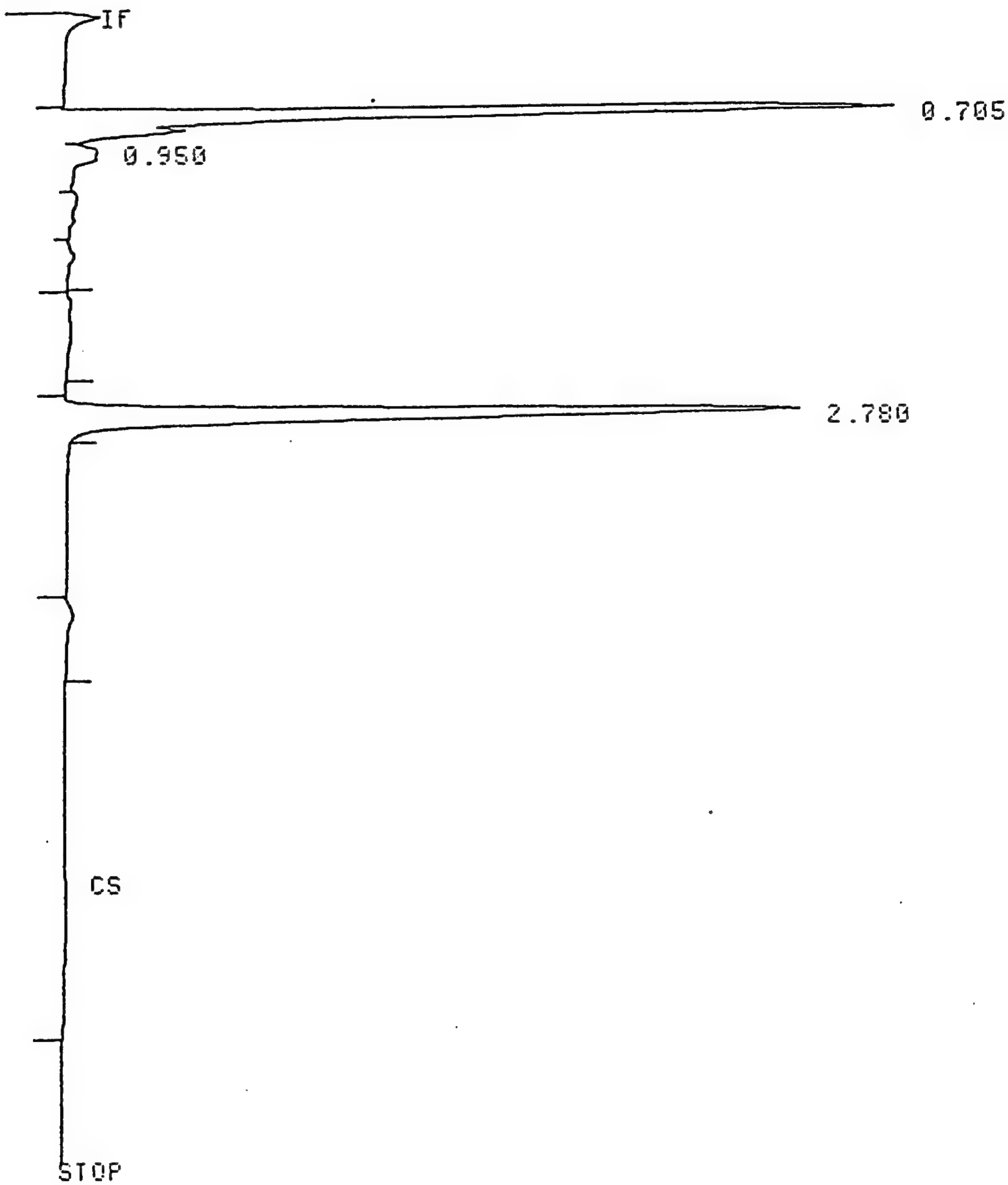
GRP#	ug/L	NAME
1	0.0000E+00	TOTAL XYLENES

* OP # 7

DEFAULT SAMPLE INFORMATION
USE SAMPLE TABLE IN MANUAL RUN [Y/N*]:

ISTD AMT [0.0000E+00]:
SAMPLE AMT [0.0000E+00]:
MUL FACTOR [2.5000E-01]:
RECALIBRATION [Y/N*]:
NAME: GW-18
REPORT MEMO: PH-06

* RUN # 39 OCT 9, 1991 10:11:29
START



Closing signal file B:Q3655803.BNC

RUN # 39

SAMPLE NAME: GW-18
PH-06

SIGNAL FILE: B:03655B03.BNC

MATHES RECON MULTIMEDIA ANALYSIS

ESTD-AREA

RT	TYPE	AREA	WIDTH	CAL#	ug/L	NAME
.705	PV	118826	.079		.000	
.950	VV	9454	.145		.000	
2.780	PB	115672	.088	3R	.000	INT. STD.

TOTAL AREA= 243952
MUL FACTOR=2.5000E-01

GRP#	ug/L	NAME
1	0.0000E+00	TOTAL XYLENES

: NAME: GW-19

IAL FILE: B:0365718A.BNC

.HES RECON MULTIMEDIA ANALYSIS

STD-AREA

RT	TYPE	AREA	WIDTH	CAL#	ug/L	NAME
.721	PV	187355	.071		.000	
2.812	PB	97062	.093	3R	.000	INT. STD.

TOTAL AREA= 284417
MUL FACTOR=2.5000E-01

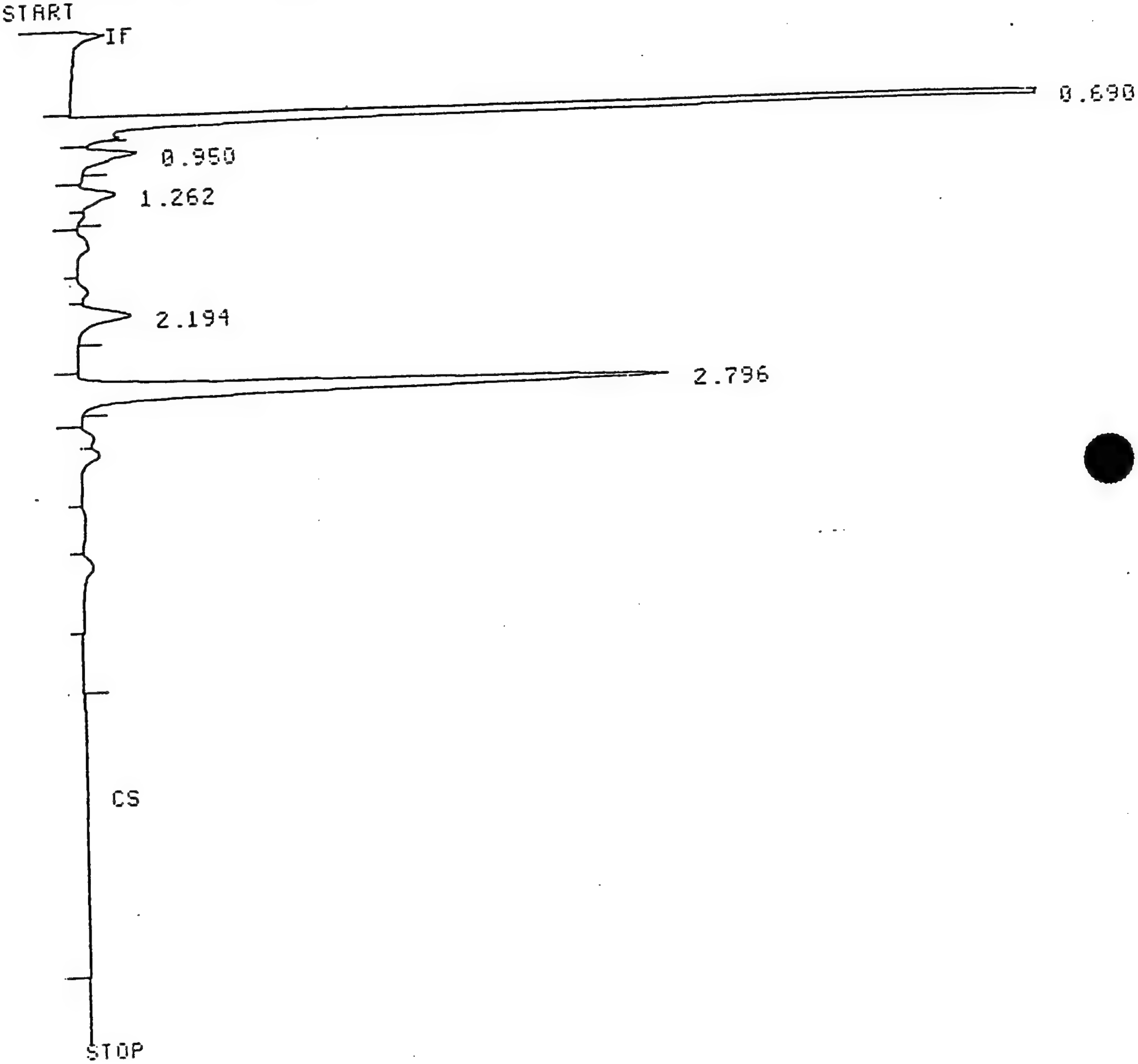
GRP#	ug/L	NAME
1	0.0000E+00	TOTAL XYLENES

* OP # 7

DEFAULT SAMPLE INFORMATION
USE SAMPLE TABLE IN MANUAL RUN [Y/N*]:

ISTD AMT [0.0000E+00]:
SAMPLE AMT [0.0000E+00]:
MUL FACTOR [2.0000E+00]: .25
RECALIBRATION [Y/N*]:
NAME: GW-20
REPORT MEMO: FH-16

* RUN #   43   OCT 9, 1991   12:14:56
START



Closing signal file B:03657801.ENC

N#   43   OCT 9, 1991 12:14:56

AMPLE NAME: GW-20
H-16

SIGNAL FILE: B:Q36578C1.BNC

MATHES RECON MULTIMEDIA ANALYSIS

ESTD-AREA

RT	TYPE	AREA	WIDTH	CAL#	ug/L	NAME
.690	PB	136165	.051		.000	
.950	BB	7752	.074		.000	
1.262	PV	6856	.090		.000	
2.194	VB	12185	.110	1	4.373	BENZENE
2.796	PB	106721	.089	3R	.000	INT. STD.

TOTAL AREA= 269679
MUL FACTOR=2.5000E-01

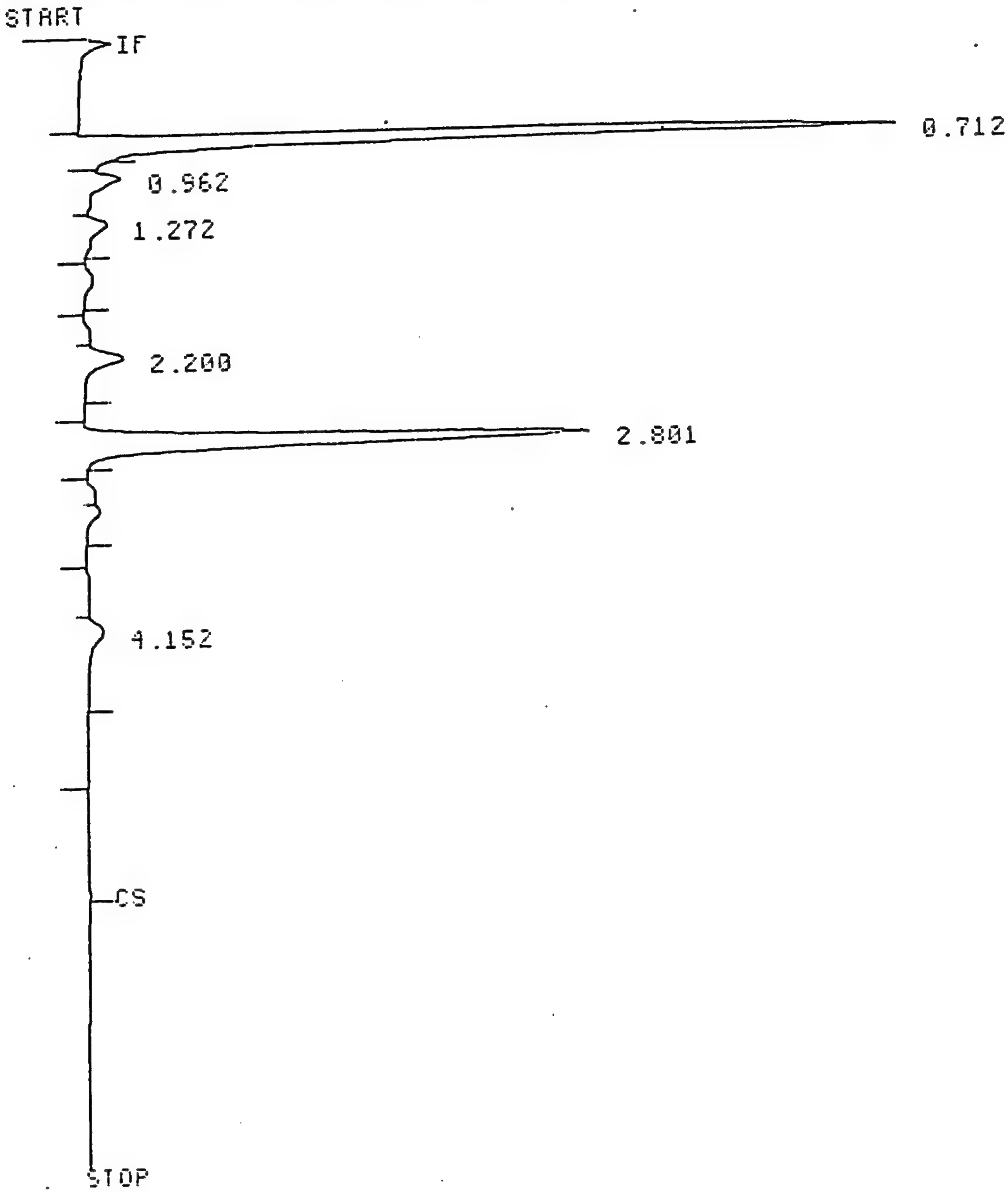
GRP#	ug/L	NAME
1	0.0000E+00	TOTAL XYLENES

* OP # 7

DEFAULT SAMPLE INFORMATION
USE SAMPLE TABLE IN MANUAL RUN [Y/N*]:

ISTD AMT [0.0000E+00]:
SAMPLE AMT [0.0000E+00]:
MUL FACTOR [2.5000E-01]:
RECALIBRATION [Y/N*]:
NAME: GW-200
REPORT MEMO: PH-16

* RUN # 44 OCT :9, 1991 12:27:41



Closing signal file B:Q3657BBE.BNC

RUN# 44 OCT 9, 1991 12:27:41

SAMPLE NAME: GW-200
PH-16

SIGNAL FILE: B:Q3657BBE.BNC

MATHES RECON MULTIMEDIA ANALYSIS

ESTD-AREA

RT	TYPE	AREA	WIDTH	CAL#	ug/L	NAME
.712	PB	100928	.068		.000	
.962	BP	3998	.077		.000	
1.272	PB	4420	.105		.000	
2.200	VB	8848	.115	1	3.176	BENZENE
2.801	PB	87658	.095	3R	.000	INT. STD.
4.152	VB	5715	.169		.000	

TOTAL AREA= 211567
MUL FACTOR=2.5000E-01

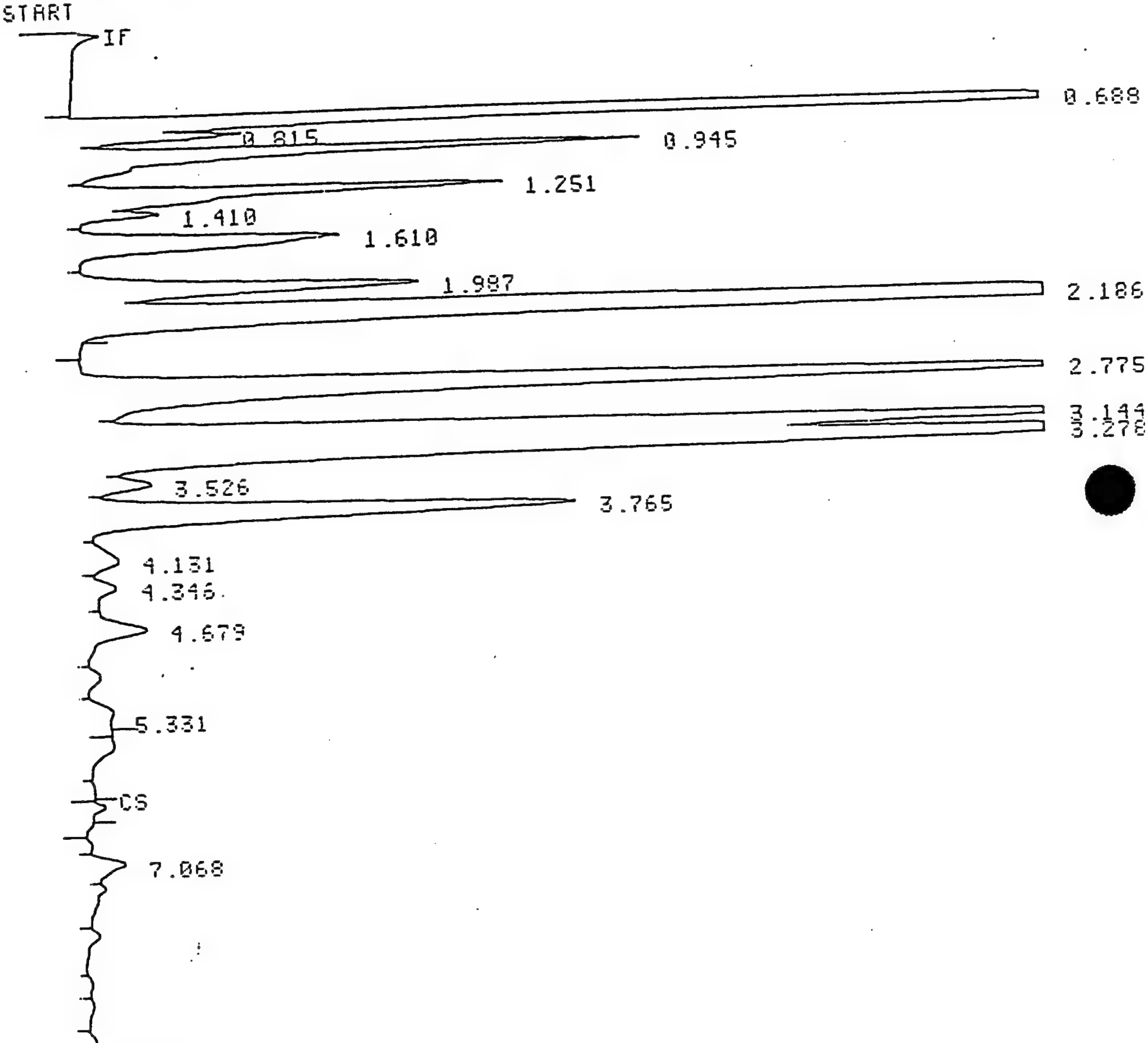
GRP#	ug/L	NAME
1	0.0000E+00	TOTAL XYLENES

+ OP # 7

DEFAULT SAMPLE INFORMATION
USE SAMPLE TABLE IN MANUAL RUN [Y/N*]:

ISTD AMT [0.0000E+00]:
SAMPLE AMT [0.0000E+00]:
MUL FACTOR [2.5000E-01]:
RECALIBRATION [Y/N*]:
NAME: GW-21
REPORT MEMO: PH-17

* RUN # 45 OCT 9, 1991 12:40:11
START



STOP

Closing signal file B:03657EAC.BNC

AMPLE NAME: GW-21
/H-17

SIGNAL FILE: B:Q3657EAC.BNC

MATHES RECON MULTIMEDIA ANALYSIS

ESTD-AREA

RT	TYPE	AREA	WIDTH	CAL#	ug/L	NAME
.688	PV	528259	.047		.000	
.815	VV	21105	.060		.000	
.945	VV	88022	.077		.000	
1.251	VV	71005	.082		.000	
1.410	VV	11038	.063		.000	
1.610	VV	58796	.112		.000	
1.987	VV	68374	.100		.000	
2.186	VB	479313	.092	1	172.029	BENZENE
2.775	PV	275309	.119	3R	.000	INT. STD.
3.144	VV	235747	.103		.000	
3.278	VV	322150	.118		.000	
3.526	VV	16869	.118		.000	
3.765	VV	127435	.128		.000	
4.131	VV	13022	.181		.000	
4.346	VV	8604	.132		.000	
4.679	VV	21776	.175		.000	
5.331	PB	3104	.118		.000	
7.068	VV	22007	.269	5	6.299	ETHYLBENZENE

TOTAL AREA=2371934
MUL FACTOR=2.5000E-01

GRP#	ug/L	NAME
1	0.0000E+00	TOTAL XYLENES

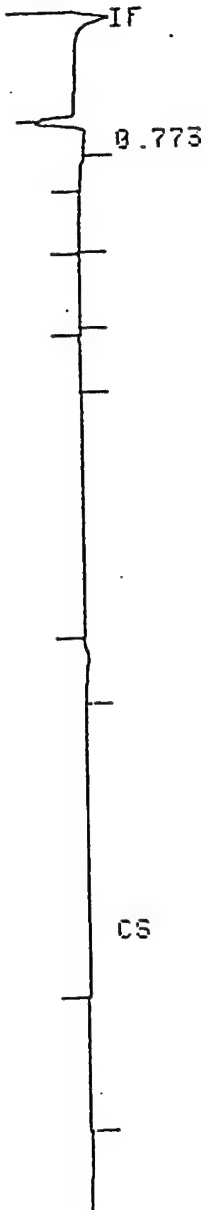
RUN #   45-003

\+ OP # 7

DEFAULT SAMPLE INFORMATION
USE SAMPLE TABLE IN MANUAL RUN [Y/N*]:

ISTD AMT [0.0000E+00]:
SAMPLE AMT [0.0000E+00]:
MUL FACTOR [2.5000E-01]:
RECALIBRATION [Y/N*]:
NAME: BLANK-10
REPORT MEMO:

* RUN # 46 OCT 9, 1991 12:57:13
START



STOP

Closing signal file B:03658?AA.BNC

RUN#   46   OCT 9, 1991 12:57:13

SAMPLE NAME: BLANK-10

SIGNAL FILE: B:Q36582AA.BNC

MATHES RECON MULTIMEDIA ANALYSIS

NO CALIB PEAKS FOUND
AREA%

RT	AREA	TYPE	WIDTH	AREA%
.773	7486	PB	.112	25.00000

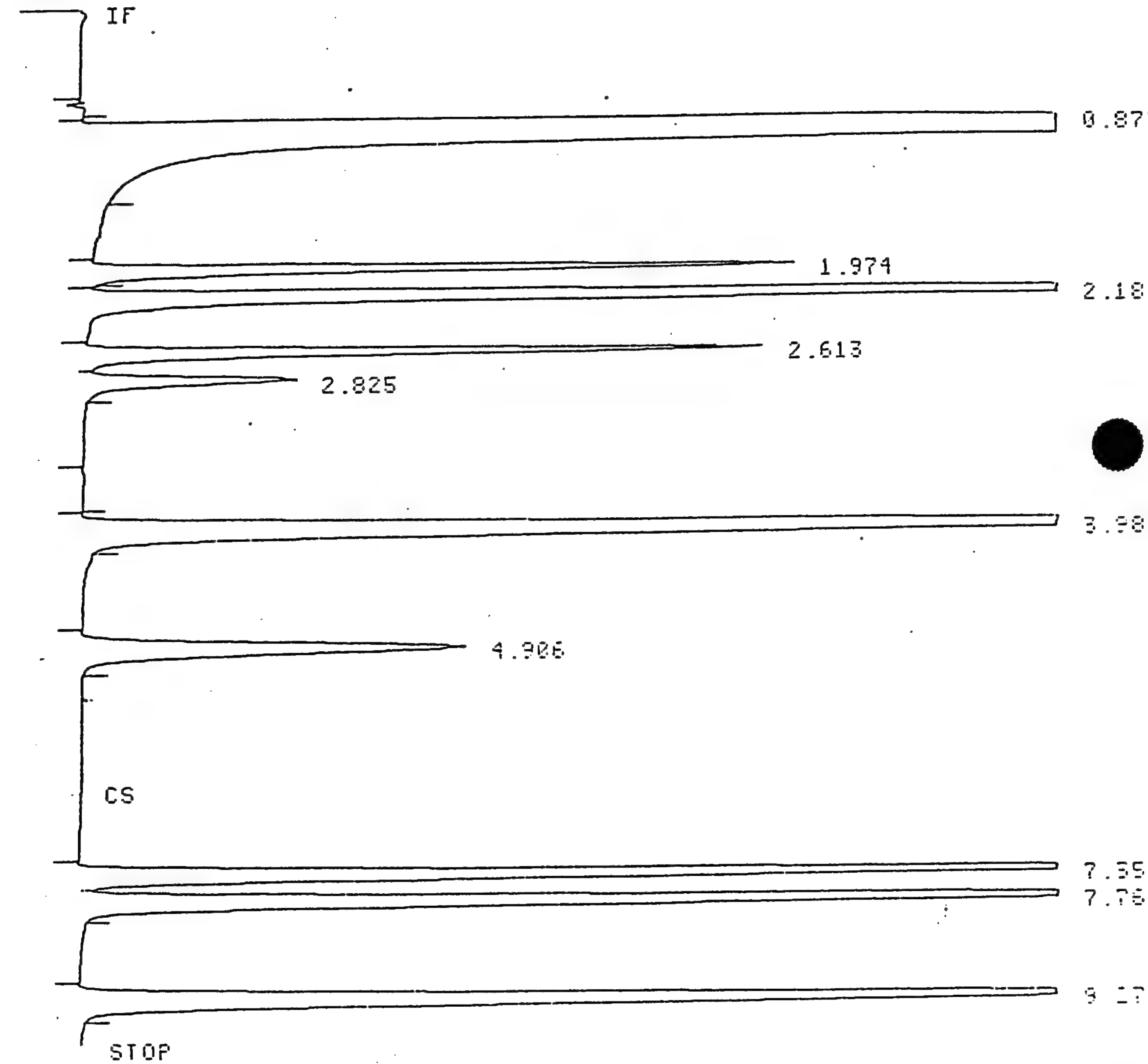
TOTAL AREA=   7486
MUL FACTOR=2.5000E-01

* GP # 7

DEFAULT SAMPLE INFORMATION
USE SAMPLE TABLE IN MANUAL RUN [Y/N*]:

ISTD AMT [0.0000E+00]:
SAMPLE AMT [0.0000E+00]:
MUL FACTOR [2.5000E-01]: 1
RECALIBRATION [Y/N*]:
NAME: RT-03
REPORT MEMO:

* RUN # 47 OCT 9, 1991 13:08:19
START



Closing signal file B:03658544.BNC

RUN# 47 OCT 9, 1991 13:08:19

SAMPLE NAME: RT-03

SIGNAL FILE: B:Q3656544.BNC

MATHES RECON MULTIMEDIA ANALYSIS

ESTD-AREA

RT	TYPE	AREA	WIDTH	CAL#	ug/L	NAME
.875	SBB	30938704	.032		.000	
1.974	PB	81848	.059		.000	
2.180	BB	335924	.054	1	482.262	BENZENE
2.613	BV	81725	.061	2	474.573	TCE
2.825	VB	32022	.076	3R	.000	INT. STD.
3.985	PB	334276	.085	4	453.932	TOLUENE
4.906	PB	78471	.103		.000	
7.352	PV	386095	.141	5	442.059	ETHYLBENZENE
7.767	VB	415050	.147	6	440.594	M&P-XYLENE
9.276	PB	430869	.171	7	427.554	O-XYLENE

TOTAL AREA=3.3115E+07
MUL FACTOR=1.0000E+00

GRP#	ug/L	NAME
1	8.6815E+02	TOTAL XYLENES

APPENDIX C

SOIL BORING LOGS, WELL INSTALLATION DIAGRAMS, AND CPT/LIF DATA SHEETS

ENGINEERING SCIENCE
DRILLING RECORD

DRILLER BOWSER MORNER
INSPECTOR CHRIS VIRNI
METHOD HOLLOW STEM AUGERING
RIG TYPE

WL	10.40'	10.70'	TOC
DATE	9/16/88	9/19/88	
TIME	1205	1304	

PROJECT RICKENBACKER ANGB
PROJECT NO CL115.13
WEATHER
START 7/19/88 1400
FINISH 7/20/88 1130

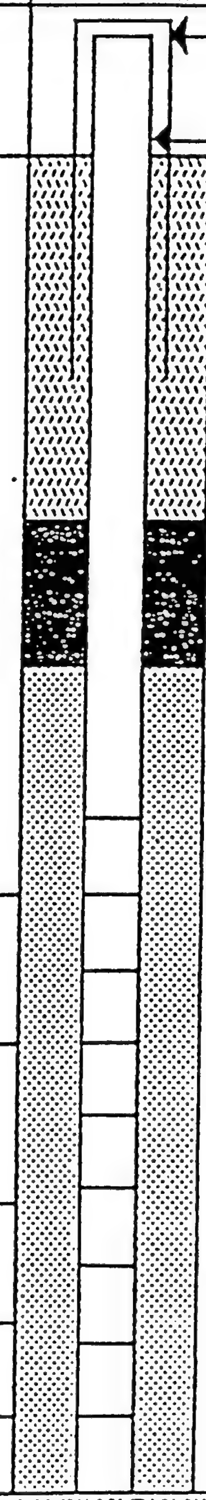
BORING NO RB-01-MW1
SHEET 1 OF 2
LOCATION 75FT E OF BLDG 560 INSIDE FENCED AREA

PLOT PLAN

PHOTOVAC	DEPTH	% RECOVERY	SPT	USCS	SOIL DESCRIPTION
			SS		
	0				
27		65	12	CL	BRN, SILTY CLAY W/TRACE OF GRAVEL, SAMP. DRY
			48		
			52		
58	2	65	12		DAMP
			12		
			9		
53		35	5		
	4		6		
			9		
16		100	7		MOIST
			12		
	6		12		
[illegible]00		100	6		MOTTLED, (BRN-RED BRN-GRY) W/SOME GRAVEL,
			8		SAMP. HAS SLIGHT HYDROCARBON ODOR
			12		
1100	8	100	5		BRN, NO MOTTLING, VY MOIST
			9		
			13		
800		100	10		
	10		10		
			13	CH	BRN-GRY, SANDY SILTY CLAY W/SOME GRAVEL, SAMP.
560		100	5		VY MOIST
			9		
	12		14		
1130		100	6	CL	BRN, SILTY CLAY W/SOME SAND AND GRAVEL, SAMP.
SS1			9		VY MOIST
			10		
1200	14	80	6		
SS2			17	SW	GRY-WHT, F-MED SAND, SAMP. WET AND HAS SHEEN ON
			14		WATER
400		100	19		
	16		18	SW	RED BRN, GRAVELLY CO. SAND, SAMP. WET
			27		
340		100	14		
			26	SW	GRY-WHT, MED. SAND, SAMP. WET
	18		30		

WELL DESIGN

COMMENTS



STANDARD PENETRATION TEST
SS = SPLIT SPOON A = AUGER CUTTINGS C = CORED

SUMMARY 0-10 SILTY CLAY SOME GRAVEL 10-12 SANDY SILTY CLAY SOME GRAVEL
12-14.3 SILTY CLAY SOME SAND AND GRAVEL 14.3-19.5 SAND

ENGINEERING SCIENCE DRILLING RECORD

DRILLER BOWSER MORNER
INSPECTOR CHRIS VIANI
METHOD HOLLOW STEM AUGERING
RIG TYPE

PROJECT RICKENBACKER ANGB
PROJECT NO CL115.13

BORING NO RB-01-MW1
SHEET 2 OF 2
LOCATION

PLOT PLAN

WL			
DATE			
TIME			

WEATHER
START
FINISH

PHOTOVAC	DEPTH	% RECOVERY	SPT	USCS	SOIL DESCRIPTION	WELL DESIGN	COMMENTS
100	18	100	10	SW	RED-BRN. SAME AS ABOVE. SAMP. WET		WELL BOTTO 19FT
			18				
			24	SW	GRY. CO. SAND W/SOME GRAVEL. SAMP. WET		
	20						
					BORING AUGERED TO 20FT		

STANDARD PENETRATION TEST
SS = SPLIT SPOON A = AUGER CUTTINGS C = CORED

SUMMARY

ENGINEERING SCIENCE
DRILLING RECORD

DRILLER: BOWSER MORNER
INSPECTOR: CHRIS VIANI
METHOD: HOLLOW STEM AUGERING
RIG TYPE:

PROJECT: RICKENBACKER ANGB
PROJECT NO: CL115.13

BORING NO: RB-01-MW2
SHEET 1 OF 1
LOCATION: NEXT TO PUMPS ON NE MARGIN OF BLDG 560 GROUNDS

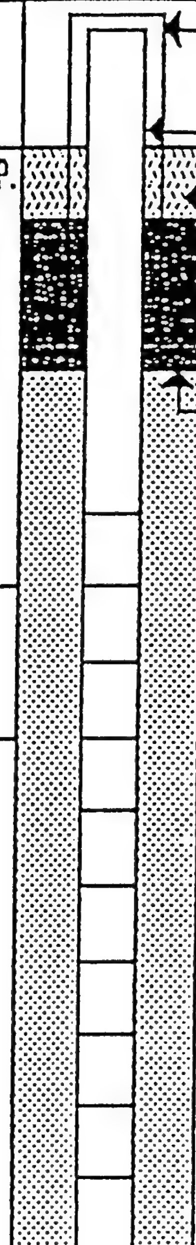
PLOT PLAN

WL	10.59'	TOC	
DATE	9/19/88		
TIME	1459		

WEATHER:
START: 7/29/88 0815
FINISH: 7/29/88 1000

PHOTOVAC	DEPTH	% RECOVERY	SPT SS	USCS	SOIL DESCRIPTION
	0				
0		75	8	CL	BRN, SILTY CLAY W/TRACE OF SAND AND GRAVEL, SAMP. MOIST
SS1			9		
SS2			7		
	2		10		
2		75	5		
SS1			6		
SS2			6		
	4		5		GRY
2		100	4		BRN
SS3			3		
			6		
	6		2		
NR		NONE	7		NO RECOVERY
			7		
			10		
	8		11		
0		100	5	CL	SAME AS ABOVE, SAMP. VY MOIST
			8		
			8		
	10		16		
0		100	11		
			21		
			27		
	12		28		
0		75	6		
			11		
			12		
	14		13		
					BORING AUGERED TO 15FT
	16				
	18				

WELL DESIGN



COMMENTS

PROTECTIVE CASING AND LOCK
2FT STICK-UP
2IN. DIA PVC RISER
CEMENT/ BENTONITE GROUT
2FT BENTONITE PELLET SEAL
SAND PACK
10FT WELL SCREEN
WELL BOTTOM 15FT

STANDARD PENETRATION TEST
SS = SPLIT SPOON A = AUGER CUTTINGS C = CORED

SUMMARY: 0-14 SILTY CLAY TRACE OF SAND AND GRAVEL

ENGINEERING SCIENCE
DRILLING RECORD

DRILLER: BOWSER MORNER
INSPECTOR: MARK J. SCHUMACKER
METHOD: HOLLOW STEM AUGERING
RIG TYPE:

PROJECT: RICKENBACKER ANGB
PROJECT NO: CL115.13

BORING NO: RB-01-M03
SHEET 1 OF 1
LOCATION: ADJACENT TO BLDG 55[illegible]

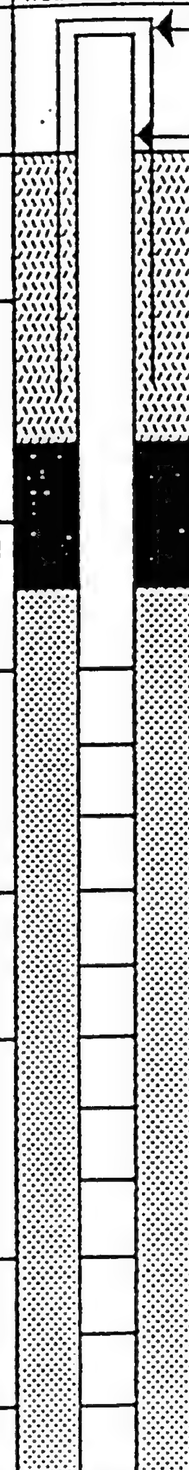
PLOT PLAN

WL	10.87'	TOC	
DATE	8/19/88		
TIME	1345		

WEATHER: 90 + HAZY
START: 8/10/88 1305
FINISH: 8/10/88 1600

PHOTOVAC	DEPTH	% RECOVERY	SPT SS	USCS	SOIL DESCRIPTION
	0				
10		100	8	OL	BRN, SILT W/LITTLE PEBBLES AND TRACE OF CLAY, SAMP. MOTTLED FROM 1.0 - 2.0FT, DRY
SS1			12		
			11		
	2		8		
					NOT SAMPLED
	4				
8.0		75	5	ML	BRN, CLAYEY SILT W/SOME PEBBLES AND TRACE OF SAND SAMP. MOIST AND PLASTIC
SS2	6		5		
			5		
			7		
					NOT SAMPLED
	8				
	10				
4.0		40	3	ML	SAME AS ABOVE
			4		
			4		
	12		5		
					NOT SAMPLED
	14				
5.0		100	15	SW	BRN, F. - MED SAND W/SOME MED. GRAVEL, SAMP. WET
	16		32		
			35		
			32		
					BORING AUGERED TO 19FT, THEN BACKFILLED TO 18FT
	18				

WELL DESIGN



COMMENTS

PROTECTIVE CASING AND LOCK

2FT STICK-[illegible]

2IN. DIA PV[illegible] RISER

CEMENT/ BENTONITE GROUT

2FT BENTONI[illegible] PELLET SEAL

SAND PACK

WELL SCREEN 10FT

WELL B[illegible] 18FT

STANDARD PENETRATION TEST
SS = SPLIT SPOON A = AUGER CUTTINGS C = CORED

SUMMARY: 0-2 SILT LITTLE PEBBLE, 5-7 CLAYEY SILT SOME PEBBLES, 10-12 SAME, 15-17 SAND AND GRAVEL

REV. DATE: JAN 1989

Page 1 of 1

BORING LOG

BORING/WELL NO.: RB-HW-AB1

Site: HWSA

Installation: Rickenbacker ANGB

Project No.: CL452.03 | Client/Project: RANGB/Hazardous Waste Storage Area

HAZWRAP Contractor: E-S Inc. | Drlg Contractor: J Mathes & Assoc | Driller: D Wright

Drlg Started: 1/22/90 (10:00 a.m) | Drlg Ended: 1/22/90 (10:30 a.m) | Borehole dia(s): 6"

Drlg Method/Rig Type: Hollow stem auger + split spoon / CME 75TA

Logged by: G.O. Carpenter | E-Log (Y/N) From ____ to ____ | Protection Level: D

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	Microtip (ppm)	Recovery (%)	Lithologic Description	USCS	Blows/6 inch.	Graphic Log	Well data	Water depth & Remarks	Elev (ft)
3-5	X	3-5'	Y/3.5	0	70	CLAY light to medium brown, silty, w/ pebbles (10%) No odors.		5 3 3 5				
8-10	X	8-10'	Y/VOC	0	70	CLAY medium to dark brown, silty, to 9.5'. Light to medium gray, silty from 9.5' to 10'. No odors. Moist.		3 5 5 6				

TD = 10'

Depth scale: 5, 10, 15, 20, 25, 30

Columns: A B C D E F G H I J K L M N

U = Thin wall tube
S = Split spoon (tube)
C = Cuttings

R = Rock coring ____
O = Other ____
Notes: ____

Field G/C (Make/Mod.) ____
G/C Oper.: ____

REV. DATE: JAN 1989

BORING LOG	BORING/WELL NO.: RB-HW-AB2	Page 1 of 1
		Site: HWSA
Installation: Rickenbacker ANGB		
Project No.: CL452.03	Client/Project: RANGB/Hazardous Waste Storage Area	
	Drlg Contractor: J. Mathes & Assoc	Driller: D Wright
HAZWRAP Contractor: E-S Inc.		Borehole dia(s): 6"
Drlg Started: 1/22/90 (15:00 pm)	Drlg Ended: 1/22/90 (15:30 pm)	
Drlg Method/Rig Type: Hollow stem auger & Split spoon / CME 75 TA		Protection Level: D
Logged by: GO Carpenter	E-Log (Y/N) N From ___ to ___	

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	Micro Tip (ppm)	Recovery (%)	Lithologic Description	USCS	Blows/6 inch.	Graphic Log	Well data	Water depth & Remarks	Elev (ft)
3.5'-5'	X	3'-5'	Y/SS1	35.1	0	70	CLAY medium to dark brown, silty. No odors.		2 3 4 6			
8'-10'	X	8'-10'	Y/SS2	137	0	70	CLAY light to medium gray, silty. No odors. Moist.		2 5 7 7			

Depth scale: 5, 10, 15, 20, 25, 30

TD = 10'

U = Thin wall tube
S = Split spoon (tube)
C = Cuttings
R = Rock coring ___
O = Other ___
Notes: ___
Field G/C (Make/Mod.) ___
G/C Oper.: ___

BORING LOG

BORING/WELL NO.: RB-HW-AB3	Page 1 of 1
Installation: Rickenbacker ANGB	Site: HWSA
Project No.: CL452.03	Client/Project: RANGB/Hazardous Waste Storage Area
HAZWRAP Contractor: E-S Inc.	Drlg Contractor: J Mathes & Assoc. / Driller: D. Wright
Drlg Started: 1/23/90 (8:45 am)	Drlg Ended: 1/23/90 (9:00 am) / Borehole dia(s): 6"
Drlg Method/Rig Type: Hollow stem auger & Split spoon / CME 75 TA	Protection Level: D
Logged by: G.O. Carpenter	E-Log (Y/N) N From ______ to ______

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	Micro Tip (ppm)	hdsp (ppm)	Recovery (%)	Lithologic Description	USCS	Blows/6 inch	Graphic Log	Well data	Water depth & Remarks	Elev (ft)
3–5	X	3'-5'	Y/551	70.5	0	70	CLAY medium brown, sandy Hydrocarbon staining. Strong odors.		1 2 1 2				
8–10	X	8'-10'	Y/552	16.3	0	70	CLAY light to medium gray, silty. No odors. Moist.		2 3 4 6				

Depth scale: 5, 10, 15, 20, 25, 30

TD = 10'

U = Thin wall tube
S = Split spoon (tube)
C = Cuttings
R = Rock coring ______
O = Other ______
Notes: ______
Field G/C (Make/Mod.) ______
G/C Oper.: ______

REV. DATE: JAN 1989

BORING LOG

BORING/WELL NO.: RB-HW-AB4		Page 1 of 1
Installation: Rickenbacker ANGB	Site: HWSA	
Project No.: CL452.03	Client/Project: RANGB/ Hazardous Waste Storage Area	Driller: O. Wright
HAZWRAP Contractor: E-J Inc	Drlg Contractor: J. Mathes & Assoc.	Borehole dia(s): 6"
Drlg Started: 1/23/90 (13:20 pm)	Drlg Ended: 1/23/90 (13:50 pm)	
Drlg Method/Rig Type: Hollow-stem auger & Split spoon/ CME 75 TA		Protection Level: D
Logged by: G.O. Carpenter	E-Log (Y/N) From ______ to ______	

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	Micro Tip (ppm)	Recovery (%)	Lithologic Description	USCS	Blows/6 inch.	Graphic Log	Well data	Water depth & Remarks	Elev (ft)
5	3'-5'	V/55.0	55.0	0	30	CLAY brown, silty. W/ concrete/rock debris. No odors.		8-14				
10	8'-10'	V/39.2	39.2	0	35	CLAY gray, sandy. Black stained, hydrocarbons. Strong odor. Moist		1-5-3-6				
15												
20												
25												
30						TD = 10'						

U = Thin wall tube
S = Split spoon (tube)
C = Cuttings
R = Rock coring ______
O = Other ______
Notes: ______
Field G/C (Make/Mod.) ______
G/C Oper.: ______

REV. DATE: JAN 1989

Page 1 of 1

BORING LOG

BORING/WELL NO.: RB-HW-ABS

Site: HWSA

Installation: Rickenbacker ANGB

Project No.: CL452.03 | Client/Project: RANGB/Hazardous Waste Storage Area

Drlg Contractor: J. Mathes & Assoc | Driller: D. Wright

HAZWRAP Contractor: E-S Inc. | Borehole dia(s): 6"

Drlg Started: 1/22/90 (14:30 pm) | Drlg Ended: 1/22/90 (15:00 pm)

Drlg Method/Rig Type: Hollow stem auger; Split spoon / CME 75 TA | Protection Level: D

Logged by: G.D. Carpenter | E-Log (Y/N) N From ____ to ____

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	Microtip (ppm)	Hnsp (%) Recovery (%)	Lithologic Description	USCS	Blows/6 inch.	Graphic Log	Well data	Water depth & Remarks	Elev (ft)
5	3-5'	Y/SS1	2.5	0	70	CLAY light to medium brown, silty, w/ pebbles (10%). No odors.		5 7 7 12				
10	8-10'	Y/SS2	11.9	0	70	CLAY light to medium gray, silty, trace sand (< 10%). No odors. Moist		2 2 3 6				
15												
20												
25												
30						TD = 10'						

U = Thin wall tube
S = Split spoon (tube)
C = Cuttings
R = Rock coring ____
O = Other ____
Notes: ____
Field G/C (Make/Mod.) ____
G/C Oper.: ____

REV DATE: JAN 1989

Page 1 of 1

BORING LOG

BORING/WELL NO.: RB-HW-AB6	Site: HWSA
Installation: Rickenbacker ANGB	
Project No.: C6452.03	Client/Project: RANGB / Hazardous Waste Storage Area
Drlg Contractor: J. Mathes & Assoc	Driller: D. Wright
HAZWRAP Contractor: E-S Inc	Borehole dia(s): 6"
Drlg Started: 1/23/90 (11:00 am)	Drlg Ended: 1/23/90 (11:30 am)
Drlg Method/Rig Type: Hollow stem auger & Split spoon / CME 75TA	Protection Level: D
Logged by: G.O. Carpenter	E-Log (Y/N) N From ______ to ______

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	Direct reading (ppm)	Recovery (%)	Lithologic Description	USCS	Blows/6 inch.	Graphic Log	Well data	Water depth & Remarks	Elev (ft)
3-5	X	3-5'	Y/1331	14.C	0	70	CLAY brown, silty. W/ pebble debris (10%). No odors.		1, 2, 3, 6			
8-10	X	8-10'	Y/1332	13.7	0	70	CLAY brown to gray, sandy. No odors. Moist.		3, 5, 7, 12			

TD = 10'

U = Thin wall tube
S = Split spoon (tube)
C = Cuttings
R = Rock coring ______
O = Other ______
Notes: ______
Field G/C (Make/Mod.) ______
G/C Oper.: ______

REV. DATE: JAN 1989

BORING LOG	BORING/WELL NO.: RB-HW-AB7		Page 1 of 1
Installation: Rickenbacker ANGB		Site: HWSA	
Project No.: CL452.03	Client/Project: RANGB / Hazardous Waste Storage Area		
HAZWRAP Contractor: E-J Inc.	Drlg Contractor: J. Mathes & Assoc.	Driller: D. Wright	
Drlg Started: 1/23/90 (14:00 pm)	Drlg Ended: 1/23/90 (14:30 pm)	Borehole dia(s): 6"	
Drlg Method/Rig Type: Hollow stem auger & Split spoon / CME 75TA			Protection Level: D
Logged by: G.O. Carpenter	E-Log (Y/N) N From ____ to ____		

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	HNu/OVA (ppm)	Recovery (%)	Lithologic Description	USCS	Blows/6 inch.	Graphic Log	Well data	Water depth & Remarks	Elev (ft)
3.5–5	S	3.5-5'	Y	15.0	0	70	CLAY medium brown, silty. No odors		1 3 5 6				
8.5–10	S	8.5-10'	Y	400.0	0	70	CLAY gray, sandy. No odors. Moist.		2 3 4 5				

TD = 10'

Depth scale: 5, 10, 15, 20, 25, 30

U = Thin wall tube
S = Split spoon (tube)
C = Cuttings
R = Rock coring ____
O = Other ____
Notes: ____
Field G/C (Make/Mod.) ____
G/C Oper.: ____

REV. DATE: JAN 1989

BORING LOG	BORING/WELL NO.: RB-HW-AB2		Page 1 of 1
Installation: Rickenbacker ANGB		Site: HWSA	
Project No.: CL452.03	Client/Project: RANGB/Hazardous Waste Storage Area		
HAZWRAP Contractor: E-S Inc.	Drlg Contractor: J Mathes & Assoc		Driller: D Wright
Drlg Started: 1/22/90 (13:20pm)	Drlg Ended: 1/22/90 (13:50pm)		Borehole dia(s): 6"
Drlg Method/Rig Type: Hollow stem auger & Split spoon/CME 75TA			
Logged by: G.G. Carpenter	E-Log (Y/N) From ____ to ____		Protection Level: D

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	Micro tip (ppm)	Recovery (%)	Lithologic Description	USCS	Blows/6 inch.	Graphic Log	Well data	Water depth & Remarks	Elev (ft)
3.5-5	3-5'	Y/S51	5.7	0	70	CLAY light to medium brown, silty, w/ pebbles (10%). No odors.		3 6 9 11				
8-10	8-10'	Y/S52	22.0	0	70	CLAY medium to dark brown, silty, w/ pebbles (10%) No odors. Moist.		2 4 5 5				

Depth scale: 5, 10, 15, 20, 25, 30

TD = 10'

U = Thin wall tube
S = Split spoon (tube)
C = Cuttings
R = Rock coring ____
O = Other ____
Notes: ____
Field G/C (Make/Mod.) ____
G/C Oper.: ____

REV. DATE: JAN 1989

BORING LOG	BORING/WELL NO.: RB-HW-AB9		Page 1 of 1
Installation: Rickenbacker ANGB		Site: HWSA	
Project No.: CC452.03	Client/Project: RANGB/ Hazardous Waste Storage Area		
HAZWRAP Contractor: E-S Inc	Drlg Contractor: J. Mathes & Assoc	Driller: D. Wright	
Drlg Started: 1/23/90 (9:30 am)	Drlg Ended: 1/23/90 (9:45 am)	Borehole dia(s): 6"	
Drlg Method/Rig Type: Hollow stem auger / Split spoon / CME 75 TA			
Logged by: G.D. Carpenter	E-Log (Y/N) From ____ to ____		Protection Level: D

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	Micro Tip hnsp (ppm)	Recovery (%)	Lithologic Description	USCS	Blows/6 inch.	Graphic Log	Well data	Water depth & Remarks	Elev (ft)
5	X	3'-5'	Y/331	13.6	0	70	CLAY medium brown, silty, w/ pebbles (10%). No odors.		1 2 3 4			
10	X	8'-10'	Y/332	19.8	0	70	CLAY gray silty, w/ pebbles (10%). No odors. Moist		1 2 3 4			
15												
20												
25												
30						TD = 10'						

U = Thin wall tube
S = Split spoon (tube)
C = Cuttings
R = Rock coring ____
O = Other ____
Notes: ____
Field G/C (Make/Mod.) ____
G/C Oper.: ____

REV. DATE: JAN 1989

BORING LOG	BORING/WELL NO.: RB-HW-AB10	Page 1 of 1
		Site: HWSA
Installation: Rickenbacker ANGB		
Project No.: CC452.03	Client/Project: RANGB/Hazardous Waste Storage Area	
HAZWRAP Contractor: F-S Inc.	Drlg Contractor: J. Mathes & Assoc	Driller: O. Wright
Drlg Started: 1/23/90 (: _m)	Drlg Ended: 1/23/90 (: _m)	Borehole dia(s):
Drlg Method/Rig Type:		Protection Level: D
Logged by: G.C. Carpenter	E-Log (Y/N) From ____ to ____	

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	Microtip (ppm)	Recovery (%)	Lithologic Description	USCS	Blows/6 inch.	Graphic Log	Well data	Water depth & Remarks	Elev (ft)
5	X	3'-5'	Y/SS	31.3	0	70 — CLAY medium brown, silty. No odors.		1-2-3-3				
10	X	8'-10'	Y/SS	184	0	70 — CLAY dark brown to gray, silty. No odors. Moist.		3-3-2-3				
15												
20												
25												
30						TD = 10'						

U = Thin wall tube
S = Split spoon (tube)
C = Cuttings
R = Rock coring ____
O = Other ____
Notes: ____
Field G/C (Make/Mod.) ____
G/C Oper.: ____

REV. DATE: JAN 1989

BORING LOG

BORING/WELL NO.: RR-HW1-AB11		Page 1 of 1
Installation: Rickenbacker ANGB		Site: HWSA
Project No.: 22452.03	Client/Project: RANGB/Hazardous Waste Storage Area	
HAZWRAP Contractor: E-S Inc	Drlg Contractor: J. Mathes & Assoc	Driller: D. Wright
Drlg Started: 1/26/90 (9:50 am)	Drlg Ended: 1/26/90 (11:20 am)	Borehole dia(s): 6"
Drlg Method/Rig Type: Hollow stem auger & Split spoon / CME 75TA		Protection Level: D
Logged by: G.O. Carpenter	E-Log (Y/N) N From ______ to ______	

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	Microtip (ppm)	hnsp	Recovery (%)	Lithologic Description	USCS	Blows/6 inch.	Graphic Log	Well data	Water depth & Remarks	Elev.(ft)
3-5	3-5'	[illegible]		7.6	0	70	CLAY brown, silty. No odors.		2 4 5 8				
8-10	8-10'	[illegible]		45.6	0	70	Clay brown, silty. No odors.		3 3 4 6				
13-15	13-15'	[illegible]		12.2	0	70	Clay brown, silty. W/ pebbles (10%). No odors. Moist.		3 5 7 9				
15-17	15-17'	[illegible]	Y	3180	0	70	Gravel - brown, sandy. No odors. Wet.		2 3 5 7				
17-19	17-19'	[illegible]		90.1	0	70	Gravel - brown, sandy. No odors. Wet. Gray silty clay @ 18.5' to 19.0'.		5 7 11 14				
19-21	19-21'	[illegible]		19.1	0	70	Gravel - brown, sandy, to 19.5'. Gray sandy gravel from 19.5' to 21'. No odors. Wet.		11 21 22 22				
21-23	21-23'	[illegible]	Y	27.1	0	70	Gravel - brown, sandy. No odors. Wet.		7 11 23 30				

TD = 23'

U = Thin wall tube
S = Split spoon (tube)
C = Cuttings
R = Rock coring ______
O = Other ______
Notes: ______
Field G/C (Make/Mod.) ______
G/C Oper.: ______

REV. DATE: JAN 1989

BORING LOG	BORING/WELL NO.: LB-HW-AG12		Page 1 of 1
		Site: HWSA	
Installation: Rickenbacker ANGB			
Project No.: CL452.03	Client/Project: RANGB/Hazardous Waste Storage Area		
HAZWRAP Contractor: E-S Inc.	Drlg Contractor: J. Mathes & Assoc.	Driller: R. Wright	
Drlg Started: 1/24/90 (9:10 am)	Drlg Ended: 1/24/90 (10:30 am)	Borehole dia(s): 6"	
Drlg Method/Rig Type: Hollow stem auger / Split spoon / CME 75TA			Protection Level: D
Logged by: G.O. Carpenter	E-Log (Y/N) From ______ to ______		

Depth (ft)	Sample No.	Lab Anal. (Y/N)	Micro tip	hnu (ppm)	Recovery (%)	Lithologic Description	USCS	Blows/6 inch	Graphic Log	Well data	Water depth & Remarks	Elev (ft)
5	3-5'	SS-1	9.5	0	70	CLAY medium brown, silty. w/ pebbles (10%). No odors.		2, 2, 10, 10				
10	8-10'	SS-2	6.1	0	70	CLAY dark brown, sandy. Cinder/pebble debris (<10%). No odors. Moist		2, 3, 6, 10				
15	13-15'	Y/SS-3	91.8	0	70	CLAY brown, sandy. Hydrocarbon staining. Grayish sand from 14.5-15'. Fine to medium grained. Well sorted. Wet.		2, 4, 8, 11				
	15-17'	SS-4	29.5	0	70	Sand - medium. Small gravel throughout (50%). Hydrocarbon staining. Slight odor. Wet.		3, 7, 11, 12				
20	17-19'	SS-5	10.1	0	70	Sand - medium grained, sand/gravel to 18'. brown well sorted fine sand @ 18-18.5'. Gray silty clay @ 18.5-19'. No odors. Wet.		5, 11, 19, 20				
	19-21'	SS-6	15.3	0	70	Gravel - sandy from 19-20.5'. Brown well sorted fine sand, from 20.5' to 21'. No odors. Wet.		0, 5, 13, 15				
25	21-23'	Y/SS-7	12.0	0	70	Gravel - sandy, from 21-22.5'. Light gray hard clay. Wet. No odors.		5, 16, 20, 24				
30						TD = 23'						

U = Thin wall tube
S = Split spoon (tube)
C = Cuttings
R = Rock coring ______
O = Other ______
Notes: ______

Field G/C (Make/Mod.) ______
G/C Oper.: ______

REV. DATE: JAN 1989

BORING LOG

BORING/WELL NO.: RR-HW-AB13			Page 1 of 1
Installation: Rickenbacker ANGB		Site: HWSA	
Project No.: CL452.03	Client/Project: RANGB/ Hazardous Waste Storage Area		Driller: G Wright
HAZWRAP Contractor: E-S Inc.	Drlg Contractor: J Mathes & Assoc		Borehole dia(s): 6"
Drlg Started: 1/24/90 (13:00 pm)	Drlg Ended: 1/24/90 (14:20 pm)		
Drlg Method/Rig Type: Hollow stem auger & Split spoon / CME 75TA			Protection Level: D
Logged by: G.O. Carpenter	E-Log (Y/N) N From ____ to ____		

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	Micro Tip (ppm) / hnu	Recovery (%)	Lithologic Description	USCS	Blows/6 inch.	Graphic Log	Well data	Water depth & Remarks	Elev (ft)
5	X	3-5'	SS1	3.3	0	70	CLAY medium brown, silty. Pebbles (10%) No odors.		2 4 5 6			
10	X	8-10'	SS2	4.0	0	70	CLAY brown, sandy. No odors. Moist		3 4 8 7			
	X	13-15'	SS3	13.6	0	70	Till medium brown sandy gravel. Wet. No odors.		3 7 16 17			
15	X	15-17'	SS4	10.6	0	70	Till brown sandy gravel. Wet. No odor.		7 15 24 21			
	X	17-19'	SS5	15.2	0	70	Till gray sandy gravel, to 18', wet. Fine well sorted gray sand @ 18.0' to 18.5'. Wet. Gray silty clay @ 18.5' to 19.0'.		7 11 11 18			
20	X	19-21'	SS6	8.2	0	70	Till medium sandy gravel to 20'. Coarse sandy gravel from 20'-21'. No odors. Wet.		5 7 10 21			
	X	21-23'	SS7	9.3	0	70	Till gray sandy gravel. No odors. Wet.		16 33 45 44			
25												
30							TD = 23'					

U = Thin wall tube
S = Split spoon (tube)
C = Cuttings
R = Rock coring ____
O = Other ____
Notes: ____
Field G/C (Make/Mod.) ____
G/C Oper.: ____

REV. DATE: JAN 1989

BORING LOG

BORING/WELL NO.: RB-HW-AB14	Page 1 of 1
Site: HWSA	
Installation: Rickenbacker ANGB	
Project No.: CL452.03	Client/Project: RANGB/Hazardous Waste Storage Area
Drlg Contractor: J Mathes & Assoc	Driller: D. Wright
HAZWRAP Contractor: E-S Inc.	Borehole dia(s): 6"
Drlg Started: 1/25/90 (14:00 pm)	Drlg Ended: 1/25/90 (15:30 pm)
Drlg Method/Rig Type: Hollow stem auger c Split spoon / CME 75 TA	Protection Level: 0
Logged by: GO. Carpenter	E-Log (Y/N) From ______ to ______

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	Micro Tip (ppm)	Recovery (%)	Lithologic Description	USCS	Blows/6 inch.	Graphic Log	Well data	Water depth & Remarks	Elev (ft)
3-5	3-5'	SS1	36.5	0	70	CLAY - brown, silty. No odors		1 2 7 9				
7-10	7'-10	Y/SS2	1100	0	70	CLAY - brown, silty. w/ pebbles (10%). No odors.		7 9 12 15				
13-15	13-15'	SS3	885	0	70	CLAY - brown to dark gray, silty. Pebbles (<5%). No odors. Moist.		3 5 10				
15-17	15-17'	SS4	20.8	0	70	Gravel - brown, sandy. No odors. Wet.		8 9 10				
17-19	17-19'	SS5	50.2	0	70	Gravel - brown, sandy, to 18.5'. Gray silty clay 18.5'-19'. No odors. Wet.		3 9 13 20				
19-21	19-21'	SS6	280	0	70	Gravel - brown, sandy. No odors. Wet.		5 15 22 28				
21-23	21-23'	Y/SS7	10.4	0	70	Gravel - brown, sandy, to 22'. Fine well sorted brown sand 22-22.5'. Gray silty shale 22.5'-23.0'. Wet. No odors.		5 13 19 19				
23-25	23-25'	SS8	9.7	0	70	Gravel - brown, sandy, to 24'. Gray silty clay, to 25'. No odors.		6 10 14 15				

TD = 25'

U = Thin wall tube	R = Rock coring ______	Field G/C (Make/Mod.) ______
S = Split spoon (tube)	O = Other ______	G/C Oper.: ______
C = Cuttings	Notes: ______	

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BORING LOG

BORING/WELL NO.: RB-HW-AB15	Page 1 of 1
Installation: Rickenbacker ANGB	Site: HWSA
Project No.: CL452.03	Client/Project: RANGB / Hazardous Waste Storage Area
HAZWRAP Contractor: E-S Inc.	Drlg Contractor: J. Mathes & Assoc.
Driller: D. Wright	
Drlg Started: 1/25/90 (7:20 am)	Drlg Ended: 1/25/90 (11:50 am)
Borehole dia(s): 6"	
Drlg Method/Rig Type: Hollow stem auger & Split spoon / CME 75 TA	
Logged by: G.O. Carpenter	E-Log (Y/N) N From ______ to ______
Protection Level: D	

Depth (ft)	Sample No.	Lab Anal. (Y/N)	Microtip HNU (ppm)	Recovery (%)	Lithologic Description	USGS	Blows/6 inch.	Graphic Log	Well data	Water depth & Remarks	Elev (ft)
3-5'	331	9.2	0	70	Clay brown, silty. Pebbles (10%). No odors.		2 3 4 3				
8'-10'	332	54.0	0	70	Clay gray, silty. Small pebble debris (<5%). No odors. Moist.		1 1 3 2				
13'-15'	Y/333	79C	0	70	Clay brown to gray, silty. No odors. Moist.		1 1 2 1				
15'-17'	334	401	0	70	Gravel - brown, sandy. No odors. Wet.		2 3 7 11				
17-19'	335	721	0	70	Gravel - brown, sandy, to 18'. Gray silty clay from 18' to 19'. No odors. Wet.		5 7 9 14				
19-21'	336	27.0	0	70	Gravel - brown, sandy, to 20'. Grading into larger sandy gravel @ 20' on. Wet.		7 8 27 33				
21-23'	337	40.9	0	70	Sand - brown, fine well sorted. Wet. Coarse sandy gravel from 22-23'. Wet.		12 17 22 30				
23'-25'	04	13.5	0	70	Gravel - brown, sandy, w/ fine well sorted sand lenses interbedded. No odors. Wet.		7 9 12 15				
25'-27'	Y/337	9.7	0	70	Gravel - gray, sandy, to 26'. Wet. Gray silty clay. Wet. 26'-27'. TD=27'		5 6 12 22				

U = Thin wall tube
S = Split spoon (tube)
C = Cuttings
R = Rock coring ______
O = Other ______
Notes: ______
Field G/C (Make/Mod.) ______
G/C Oper.: ______

REV. DATE: JAN 1989

BORING LOG

BORING/WELL NO.: RR-HW-MW4	Page 1 of 1
Site: HWSA	
Installation: Rickenbacker ANGB	
Project No.: CL452.03	Client/Project: RANGB/Hazardous Waste Storage Area
HAZWRAP Contractor: E-S Inc.	Drlg Contractor: J Mathes & Assoc.
Driller: G Mingle	Borehole dia(s): 6"
Drlg Started: 1/29/90 (13:35 pm)	Drlg Ended: 1/29/90 (15:00 pm)
Drlg Method/Rig Type: Hollow stem auger & Split spoon / CME 75TA	Protection Level: D
Logged by: G.C. Carpenter	E-Log (Y/N) N From ____ To ____

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	Photo. (ppm)	Recovery (%)	Lithologic Description	USCS	Blows/6 inch.	Graphic Log	Well data	Water depth & Remarks	Elev.(ft)
5	3'-5'	SS-1	9.C	0	70	Clay brown, silty. No odors.		3 4 6 7				
10	7'-10'	Y/SS-2	66.7	0	70	Clay brown, silty, to 9'9". Brown sandy clay from 9'9" to 10'. No odors. Moist.		2 3 7 10				
15	13'-15'	Y/SS-3	6.0	0	70	Sand brown silty, to 13.5'. Brown sandy clay/silty sand from 13.5' to 15'. No odors. Wet.		2 4 5 6				
20												
25												
30												

TD = 16'

U = Thin wall tube
S = Split spoon (tube)
C = Cuttings
R = Rock coring ____
O = Other ____
Notes: ____
Field G/C (Make/Mod.) ____
G/C Oper.: ____

REV. DATE: JAN 1989

BORING LOG

BORING/WELL NO.: RB-HW-MW5	Page 1 of 1
Installation: Rickenbacker ANGB	Site: HWSA
Project No.: CL452.03	Client/Project: RANGB/Hazardous Waste Storage Area
HAZWRAP Contractor: E-S Inc	Drlg Contractor: J. Mather & Assoc
Driller: D Clark	
Drlg Started: 1/31/90 (9:30 a m)	Drlg Ended: 1/31/90 (10:30 a m)
Borehole dia(s): 8"	
Drlg Method/Rig Type: Hollow stem auger & split spoon / CME75TA	Protection Level: D
Logged by: G.O. Carpenter	E-Log (Y/N) N From ___ to ___

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	HNu/OVA (ppm)	Recovery (%)	Lithologic Description	USCS	Blows/6 inch.	Graphic Log	Well data	Water depth & Remarks	Elev (ft)
3-5	X	3-5'	Y/SS1	94	0 / 70	Clay brown, silty. W/ pebbles (10%). No odors.		1 3 4 4				
8-10	X	8-10'	Y/SS2	2280	0 / 70	Clay brown, sandy/silty Wet. No odors.		1 1 2 4				
13-15	X	13-15'	Y/SS3	2376	0 / 70	Sand gray fine to medium well sorted. Wet. Strong odors. Interbedded sandy gray clay @ 14'-14.5'.		5 10 11 10				

Depth scale: 5, 10, 15, 20, 25, 30

TD = 16'

U = Thin wall tube
S = Split spoon (tube)
C = Cuttings
R = Rock coring ___
O = Other ___
Notes: ___
Field G/C (Make/Mod.) ___
G/C Oper.: ___

REV. DATE: JAN 1989

BORING LOG	BORING/WELL NO.: RB-HW-MW6	Page 1 of 1
Installation: Rickenbacker ANGB		Site: HWSA
Project No.: CL452C3	Client/Project: RANGB / Hazardous Waste Storage Area	
HAZWRAP Contractor: E-S Inc	Drlg Contractor: J Mathes & Assoc	Driller: G. Mayle
Drlg Started: 1/30/90 (9:45 am)	Drlg Ended: 1/30/90 (11:30 am)	Borehole dia(s): 6"
Drlg Method/Rig Type: Hollow stem auger & Split spoon / CME 75TA		Protection Level: D
Logged by: G.C. Carpenter	E-Log (Y/N) N From ______ To ______	

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	Micro	ppm	Recovery (%)	Lithologic Description	USCS	Blows/6 inch.	Graphic Log	Well data	Water depth & Remarks	Elev (ft)
3–5	X	3-5'	Y/3.5'	10.3	0	70	CLAY brown, silty. W/ pebbles (10%). No odors.		4 5 8 10				
7–10	X	7-10'	Y/10.2	5.7	0	70	CLAY brown, silty. Trace pebbles (<5%). Moist. No odors.		1 3 5 8				
11–13	X	11-13'	Y/106	1304	0	70	CLAY brown, silty. Moist. No odors.		3 4 4 7				
13–15	X	13-15'	Y/353	231	0	70	CLAY gray, sandy, to 14'. Brown sandy gravel fill from 14 to 15'. Wet. No odors.		2 4 11 12				

Depth scale: 5, 10, 15, 20, 25, 30

TD = 16'

U = Thin wall tube
S = Split spoon (tube)
C = Cuttings
R = Rock coring ______
O = Other ______
Notes: ______
Field G/C (Make/Mod.) ______
G/C Oper.: ______

REV. DATE: JAN 1989

BORING LOG	BORING/WELL NO.: RB-HW-MW7		Page 1 of 1
Installation: Rickenbacker ANGB		Site: HWSA	
Project No.: CL452.03	Client/Project: RANGB / Hazardous Waste Storage Area		
HAZWRAP Contractor: E-S Inc.	Drlg Contractor: J. Mathes & Assoc.		Driller: G. Mayle
Drlg Started: 1/30/90 (13:00 pm)	Drlg Ended: 1/30/90 (14:10 pm)		Borehole dia(s): 6"
Drlg Method/Rig Type: Hollow stem auger & Split spoon / CME 75 TA			Protection Level: 0
Logged by: G.D. Carpenter	E-Log (Y/N) From ______ to ______		

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	Micro Tip hdsp (ppm)	Recovery (%)	Lithologic Description	USCS	Blows/6 inch.	Graphic Log	Well data	Water depth & Remarks	Elev (ft)
3-5	X	3-5'	3-5'	43.8	0 70	Clay brown, silty. No odors		1 3 4 7				
8-10	X	7-10'	Y/553	930	0 70	Clay brown, sandy. Hydrocarbon staining. Strong odors. Moist.		0 1 1 2				
11-13	X	11-13'	Y/07	99.1	0 70	Clay gray, silty. Hydrocarbon staining. Moist. Odors.		0 1 1 2				
13-15	X	13-15'	Y/553	155	0 70	Clay gray sandy, to 14.5'. Wet. Slight odor. Gray sandy gravel till. Wet. No odors.		1 1 1 2				

TD = 16'

U = Thin wall tube	R = Rock coring ______	Field G/C (Make/Mod.) ______
S = Split spoon (tube)	O = Other ______	G/C Oper.: ______
C = Cuttings	Notes: ______	

REV. DATE: JAN 1989

BORING LOG

BORING/WELL NO.: RB-HW-MW8	Page 1 of 1
Installation: Rickenbacker ANGB	Site: HWSA
Project No.: CL452.03	Client/Project: RANGB / Hazardous Waste Storage Area
Drlg Contractor: J Mathes & Assoc	Driller: R Moyle
HAZWRAP Contractor: E-S Inc.	Borehole dia(s): 6"
Drlg Started: 1/30/90 (15:00 pm)	Drlg Ended: 1/30/90 (16:30 pm)
Drlg Method/Rig Type: Hollow stem auger / Split spoon / CME 75TA	Protection Level: D
Logged by: G.C. Carpenter	E-Log (Y/N) N From ____ to ____

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	Micro Tip (ppm)	Recovery (%)	Lithologic Description	USCS	Blows/6 inch.	Graphic Log	Well data	Water depth & Remarks	Elev (ft)
3-5'	S	3-5'	13.0	0	70	Clay brown, silty. w/ pebbles (10%). No odors.		3 5 6 7				
8-10'	S	8-10'	11.9	0	70	Clay brown to gray, sandy. w/ pebbles (<5%) and interbedded brown sands. No odors. Moist.		3 4 8 12				
13-15'	S	13-15'	12.9	0	70	Gravel - gray, sandy. Wet, no odors. Gray sandy clay from 14'-14.5', w/ pebbles (<5%).		3 4 14 17				

TD = 16'

U = Thin wall tube
S = Split spoon (tube)
C = Cuttings
R = Rock coring ____
O = Other ____
Notes: ____
Field G/C (Make/Mod.) ____
G/C Oper.: ____

REV. DATE: JAN 1989

BORING LOG	BORING/WELL NO.: RR-HW-MW9	Page 1 of 1
Installation: Rickenbacker ANGB		Site: HWSA
Project No.: CL452.03	Client/Project: RANGB / Hazardous Waste Storage Area	
HAZWRAP Contractor: E-S Inc.	Drlg Contractor: J. Mathes & Assoc	Driller: C. Carl
Drlg Started: 2/9/90 (9:40 am)	Drlg Ended: 2/9/90 (10:20 am)	Borehole dia(s): 6"
Drlg Method/Rig Type: Hollow stem auger & Split spoon / CME 75TA		Protection Level: D
Logged by: G.C. Carpenter	E-Log (Y/N) From ____ to ____	

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	Micro-tip (ppm)	Recovery (%)	Lithologic Description	USCS	Blows/6 inch	Graphic Log	Well data	Water depth & Remarks	Elev (ft)
5	X	3-5'	SS1	90	0	70 Clay brown, silty. W/ pebbles (10%). No odors.		5 7 9 8				
10	X	8-10'	SS2	49.3	0	70 Clay brown, sandy. W/ pebbles (<5%). Moist No odors.		1 2 3 4				
15	X	13-15'	SS3	34.3	0	70 Sand brown, silty. W/ pebbles (<5%). Wet. No odors.		1 2 2 3				
20												
25												
30												

TD = 16'

U = Thin wall tube
S = Split spoon (tube)
C = Cuttings
R = Rock coring ____
O = Other ____
Notes: ____
Field G/C (Make/Mod.) ____
G/C Oper.: ____

REV. DATE JAN 1989

BORING LOG	BORING/WELL NO.: RB-HW-MW10		Page 1 of 1
Installation: RICKENBACKER ANGB		Site: HWSA-560	
Project No.: CL115.40	Client/Project: HAZWRAP		
HAZWRAP Contractor: ENGINEERING-SCIENCE	Drlg Contractor: JOHN MATHES & ASSOC.	Driller:	
Drlg Started: 10/14/91 (10:55 A m)	Drlg Ended: 10/14/91 (11:30 A m)	Borehole dia(s): 6"	
Drlg Method/Rig Type: HOLLOW STEM AUGER/CME-45			
Logged by: RLPATTON	E-log(Y/N) From ____ to ____	Protection level: D	

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	SHELL hdsp (ppm)	Recovery ( )	Lithologic Description	USCS	Blows/6 inch	Graphic Log	Well data	Water depth & Remarks	Elev. (ft)
0												
	S	1	Y	16		DRY, BROWN, SILTY CLAY, BROWN AND GREY MOTTLING, NO HC ODOR OR STAINING.		11 13 13 12				
5												
	S	2	N	12.8		DRY TO DAMP, BROWN, STIFF SILTY CLAY, NO HC ODOR OR STAINING.		5 6 12 17				
10												
	S	3	Y	11.4		GREY, VERY FINE GRAINED SAND WITH TRACE SILT, NO HC ODOR OR STAIN.		17 8 12 26				
15												
						BOH=18'.						
20												
25												
30												
35												

U = Thin wall tube
S = split spoon(tube)
C = Cuttings

R = Rock coring ____
O = Other ____
Notes: ____

Field G/C(Make/Mod.) ____
G/C Oper.: ____

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REV. DATE. JAN 1989

BORING LOG	BORING/WELL NO.: RB-HW-MW11	Page 1 of 1
Installation: RICKENBACKER ANGB		Site: HWSA-560
Project No.: CL115.40	Client/Project: HAZWRAP	
HAZWRAP Contractor: ENGINEERING-SCIENCE	Drlg Contractor: JOHN MATHES & ASSOC	Driller:
Drlg Started: 10/15/91 (09:35 Am)	Drlg Ended: 10/15/91 (10:30 A m)	Borehole dia(s): 6"
Drlg Method/Rig Type: HOLLOW STEM AUGER/CME-45		
Logged by: RLPATTON	E-log(Y/N) From ______ to ______	Protection level: D

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	SHELL hdsp (ppm)	Recovery ( )	Lithologic Description	USCS	Blows/6 inch	Graphic Log	Well data	Water depth & Remarks	Elev. (ft)
4	S	1	Y	72.3	X	DRY, BROWN, SILTY CLAY, TRACE FINE LIMESTONE GRAVELS, NO HC ODOR OR STAINING.		13 25 19 16				
9	S	2	N	65.1	X	BROWN SILTY CLAY, DRY, NO HC ODOR OR STAIN, TRACE GRAVEL (FINE), GREY MOTTLING		9 13 18 18				
14	S	3	Y	32.1	X	GREYISH-BROWN SILT, CLAY W/TRACE SAND.		6 6 8 20				
						SAND, BROWN COARSE, AND GRAVEL, WET AND SILTY, NO HC ODOR OR STAINING.						
18						BOH=18'.						

Depth scale: 0, 5, 10, 15, 20, 25, 30, 35

U = Thin wall tube
S = split spoon(tube)
C = Cuttings
R = Rock coring ______
O = Other ______
Notes: ______
Field G/C(Make/Mod.) ______
G/C Oper.: ______

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REV DATE JAN 1985

BORING LOG	BORING/WELL NO.: RB-HW-MW12		Page 1 of 1
Installation: RICKENBACKER ANGB		Site: HWSA-560	
project No.: CL115.40	Client/Project: HAZWRAP		
HAZWRAP Contractor: ENGINEERING-SCIENCE	Drlg Contractor: JOHN MATHES & ASSOC		Driller:
Drlg Started: 10/15/91 (14:30 P m)	Drlg Ended: 10/15/91 (15:00 P m)		Borehole dia(s):
Drlg Method/Rig Type: HOLLOW STEM AUGER/CME-45			
Logged by: RLPATTON	E-log(Y/N) From ______ to ______		Protection level: D

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	SHELL hdsp (ppm)	Recovery ( )	Lithologic Description	USCS	Blows/6 inch	Graphic Log	Well data	Water depth & Remarks	Elev. (ft)
0												
4	S	1	Y	43.1	X	BROWN AND GREY, STIFF, SILTY CLAY WITH TRACE LITHIC GRAVEL, NO HC ODOR OR STAINING.		7 6 6 7				
5												
9	S	2	N	23	X	BROWN GREY SILTY CLAY, DAMP-TO-MOIST, SLIGHTY MOTTLED, TRACE LITHIC GRAVEL, NO HC ODOR OR STAINING.		8 12 12 16				
10												
14	S	3	Y	24.5	X	SPOON WET; BROWN CSE SAND AND FINE GRAVEL, NO HC ODOR OR STAINING.		- - 25 -				
15												
18						BOH=18'.						
20												
25												
30												
35												

U = Thin wall tube
S = split spoon(tube)
C = Cuttings

R = Rock coring ______
O = Other ______
Notes: ______

Field G/C(Make/Mod.) ______
G/C Oper.: ______

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REV DATE JAN 1989

BORING LOG

BORING/WELL NO.: RB-HW-MW11		Page 1 of 1
Installation: RICKENBACKER ANGB		Site: HWSA-560
Project No.: CL115.40	Client/Project: HAZWRAP	
HAZWRAP Contractor: ENGINEERING-SCIENCE	Drlg Contractor: JOHN MATHES & ASSOC	Driller:
Drlg Started: 10/15/91 (09:35 Am)	Drlg Ended: 10/15/91 (10:30 A m)	Borehole dia(s): 6"
Drlg Method/Rig Type: HOLLOW STEM AUGER/CME-45		
Logged by: RLPATTON	E-log(Y/N) From ____ to ____	Protection level: D

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	SHELL hdsp (ppm)	Recovery ( )	Lithologic Description	USCS	Blows/6 inch	Graphic Log	Well data	Water depth & Remarks	Elev. (ft)
3–5	S	1	Y	72.3		DRY, BROWN, SILTY CLAY, TRACE FINE LIMESTONE GRAVELS, NO HC ODOR OR STAINING.		13 25 19 16				
8–10	S	2	N	55.1		BROWN SILTY CLAY, DRY, NO HC ODOR OR STAIN, TRACE GRAVEL (FINE), GREY MOTTLING		9 13 18 18				
13–15	S	3	Y	32.1		GREYISH-BROWN SILT, CLAY W/TRACE SAND.		6 6				
						SAND, BROWN COARSE, AND GRAVEL, WET AND SILTY, NO HC ODOR OR STAINING.		8 20				
18						BOH=18'.						

Depth scale: 0, 5, 10, 15, 20, 25, 30, 35

U = Thin wall tube	R = Rock coring ____	Field C/C(Make/Mod.) ____
S = split spoon(tube)	O = Other ____	C/C Oper.: ____
C = Cuttings	Notes: ____	

0115W11A
RX

REV. DATE: JAN 1990

WELL DEVELOPMENT LOG

WELL NO.: RB-HW-MW4	Page 1 of 1
Installation: Rickenbacker ANGB	Site: HWSA
Project No.: 6L452.03	Client/Project: RANGB / Hazardous Waste Storage Area
HAZWRAP Contractor: E-S Inc.	Dev. Contractor: John Mathes & Assoc.
Dev. Start: 2/2/90 (11:45 m)	Dev. End: 2/2/90 (12:00 m)
Csg Dia.:	Dev. Rig (Y) N
Developed by: J. Mathes & Assoc. / GOC	

Dev. Method 3L8 Pressure / suction pump, with a 200 gpm pumping ability.

Equipment 3L8 suction pump & black neoprene hose (1")

Pre-Dev. SWL 10.25' Maximum drawdown during pumping 7.66 ft at 0.67 gpm

Range and Average discharge rate 0.25 - 2.5 gpm / 0.67 gpm

Total quantity of material bailed —

Total quantity of water discharged by pumping 10 gal.

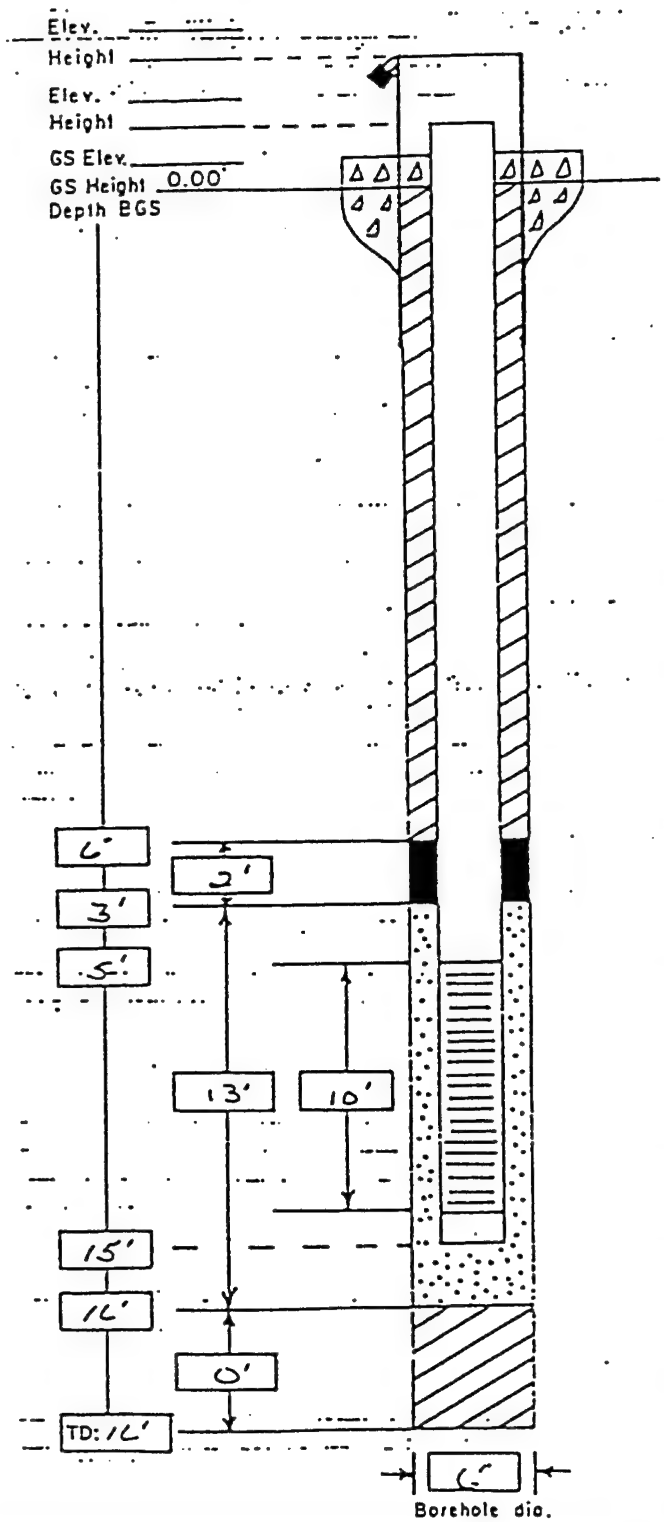
Disposition of discharge water Collected in 55 gal. secured drums located next to well.

Time	Volume Removed (gal)	Water Level ft.BTOC	Turbidity	Clarity/ Color	Temp. °C	pH	Conductivity	Remarks
11:45	2.5	17.90	high	brown	68	7.6	790	
11:50	5.0	17.90	low	light brown	63	8.0	800	
12:00	2.5	17.90	v. low	clear/ brown	61	7.8	790	Water becoming clearer
12:05	—	16.90	—	—	—	—	—	
13:00	—	12.10	—	—	—	—	—	
14:30	—	10.60	—	—	—	—	—	

REV. DATE: JAN 1989

MONITORING WELL CONSTRUCTION LOG - Standard

WELL NO.: MW5	Installation: Rickenbacker ANGB	Site: HWSA
Project No.: CL457.03	Client/Project: RANGB/ Hazardous Waste Storage Area	
HAZWRAP Contractor: E-S Inc.		Drlg Contractor: John Mathes & Assoc.
Comp. Start: 1/31/90 (9:30 _m)		Comp. End: 1/31/90 (10:30 _m)
Built By: J. Mathes & Assoc.		Well Coord.: RB-HW-MW5



PROTECTIVE CSG
Material/Type: Steel
Diameter: 4"
Depth BGS: 2.5' Weep Hole (Y/N)

GUARD POSTS (Y/N) Y
No. 3 Type 1/4" Steel Pipe

SURFACE PAD
Composition & Size: Cement, 2' x 2' x 6"

RISER PIPE
Type: Sch. 40 PVC
Diameter: 2"
Total Length (TOC to TOS): 8'

GROUT
Composition & Proportions: 5% Bentonite

Tremied (Y/N) N
Interval BGS: 0.5'-1.0'

CENTRALIZERS (Y/N) N
Depth(s):

SEAL
Type: Bentonite Pellets
Source: J. Mathes & Assoc
Setup/Hydration time: 10 min. Vol. Fluid Added: 5 gal
Tremied (Y/N) N

FILTER PACK
Type: Silica Sand
Amt Used: 200 lbs. (4 bags)
Tremied (Y/N) N
Source: J. Mathes & Assoc.
Gr. Size Dist.: 20 x 40

SCREEN
Type: Sch. 40 PVC
Diameter: 2"
Slot Size & Type: 0.01"
Interval BGS: 5'-15'

SUMP (Y/N) N
Interval BGS: Length:
Bottom Cap (Y/N)

BACKFILL PLUG None
Material:
Setup/Hydration time:
Tremied (Y/N)

REV DATE: JAN 1989

WELL DEVELOPMENT LOG	WELL NO.: RB-HW-MW5	Page 1 of 1
Installation: Rickenbacker ANGB		Site: HWSA
Project No.: CL453.03	Client/Project: RANGB/ Hazardous Waste Storage Area	
HAZWRAP Contractor: E-S Inc.	Dev. Contractor: John Mathes & Assoc.	
Dev. Start: 2/2/90 (11 : 15 m)	Dev. End: 2/2/90 (11 : 25 m)	Csg Dia.:
Developed by: J. Mathes & Assoc. / GOC		Dev. Rig (Y/N)

Dev. Method 3L8 Pressure/suction pump, with a 200 gpm pumping ability.

Equipment 3L8 suction pump & black neoprene hose (1")

Pre-Dev. SWL 12.60 Maximum drawdown during pumping 5.00 ft at 0.70 gpm

Range and Average discharge rate 0.25-5 gpm / 0.7 gpm

Total quantity of material bailed —

Total quantity of water discharged by pumping 7.5 gal.

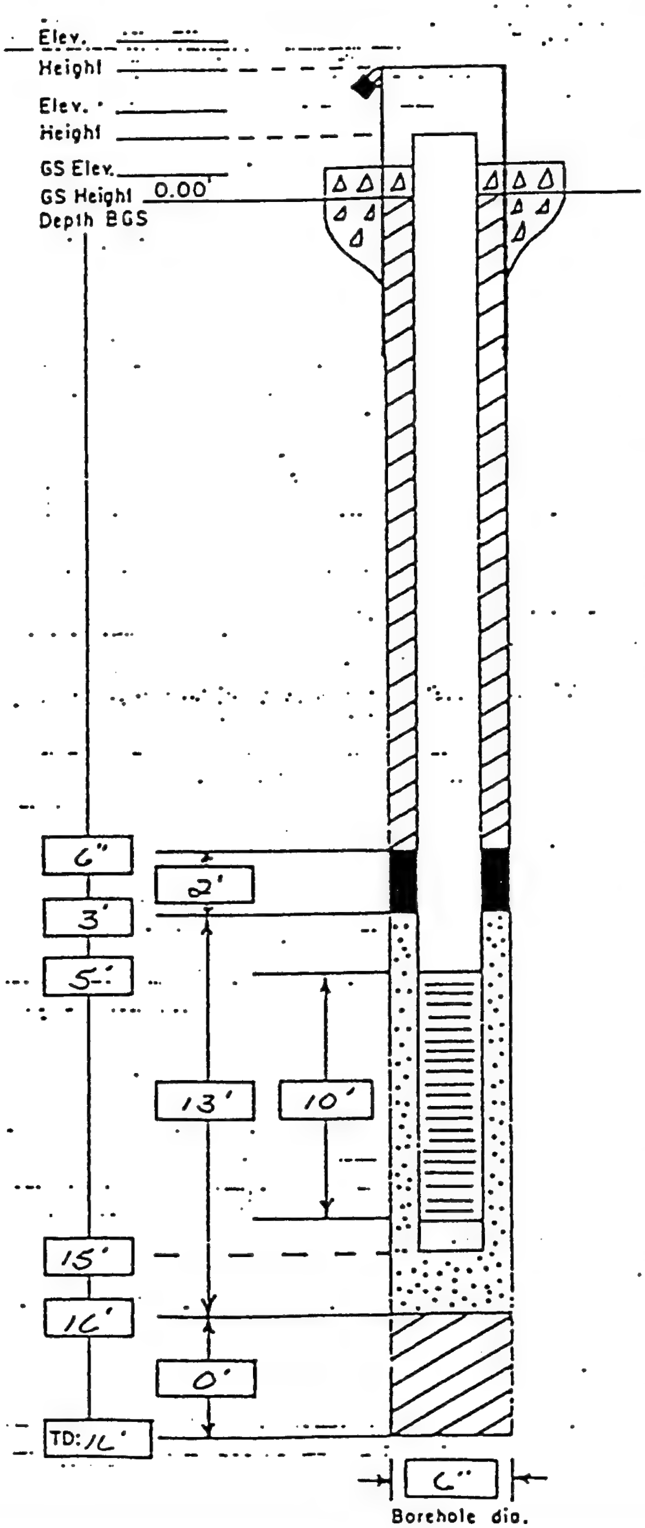
Disposition of discharge water Collected in 55 gal. secured drum located next to well.

Time	Volume Removed (gal)	Water Level ft.BTOC	Turbidity	Clarity/ Color	Temp. °C	pH	Conductivity	Remarks
11:15	5	17.60	N/A	Amber	63	8.2	630	Strong odor, product
11:25	2.5	1760	N/A	Amber	61	8.1	600	" " "
11:30	—	15.00	—	—	—	—	—	
12:05	—	13.50	—	—	-	—	—	
13:00	—	12.90	—	—	—	-	—	
14:30	—	12.80	—	-	—	—	—	

REV. DATE: JAN 1989

MONITORING WELL CONSTRUCTION LOG - Standard

WELL NO.: MW6	Installation: Rickenbacker ANGB	Site: HWSA
Project No.: CL452.03	Client/Project: RANGB / Hazardous Waste Storage Area	
HAZWRAP Contractor: E-S Inc.		Drlg Contractor: John Mathes & Assoc.
Comp. Start: 1/30/90 (9:45 _m)		Comp. End: 1/30/90 (11:30 _m)
Built By: J. Mathes & Assoc.		Well Coord.: RB-HW-MW6



PROTECTIVE CSG
Material/Type Steel
Diameter 4"
Depth BGS 2.5' Weep Hole (Y/N)

GUARD POSTS (Y/N) Y
No. 3 Type 1/4" Steel Pipe

SURFACE PAD
Composition & Size Cement, 2'x2'x6"

RISER PIPE
Type Sch. 40 PVC
Diameter 2"
Total Length (TOC to TOS) 5'

GROUT
Composition & Proportions 5% Bentonite

Tremied (Y/N) N
Interval BGS 0.5' - 1.0'

CENTRALIZERS (Y/N) N
Depth(s)

SEAL
Type Bentonite Pellets
Source J. Mathes & Assoc.
Setup/Hydration time 10 min. Vol. Fluid Added 5 gal
Tremied (Y/N) N

FILTER PACK
Type Silica Sand
Amt Used 200 lbs (4 bags)
Tremied (Y/N) N
Source J. Mathes & Assoc.
Gr. Size Dist. 20 x 40

SCREEN
Type Sch. 40 PVC
Diameter 2"
Slot Size & Type 0.01"
Interval BGS 5'-15'

SUMP (Y/N) N
Interval BGS Length
Bottom Cap (Y/N)

BACKFILL PLUG
Material None
Setup/Hydration time
Tremied (Y/N)

WELL DEVELOPMENT LOG

WELL NO.: RR-HW-MW6 | Page 1 of 1

Installation: Rickenbacker ANGB | Site: HWSA

Project No.: CL452.03 | Client/Project: RANGB/ Hazardous Waste Storage Area

HAZWRAP Contractor: E-S Inc. | Dev. Contractor: John Mathes & Assoc.

Dev. Start: 2/2/90 (12: 20 m) | Dev. End: 2/2/90 (12 : 45 m) | Csg Dia.:

Developed by: J. Mathes & Assoc / GOC | Dev. Rig (Y N)

Dev. Method 3L8 Pressure / suction pump, with a 200 gpm pumping ability.

Equipment 3L8 suction pump & black neoprene hose (1")

Pre-Dev. SWL 11.05' Maximum drawdown during pumping 6.40 ft at 0.30 gpm

Range and Average discharge rate 0.25 - 2.5 gpm / 0.3 gpm

Total quantity of material bailed —

Total quantity of water discharged by pumping 7.5 gal.

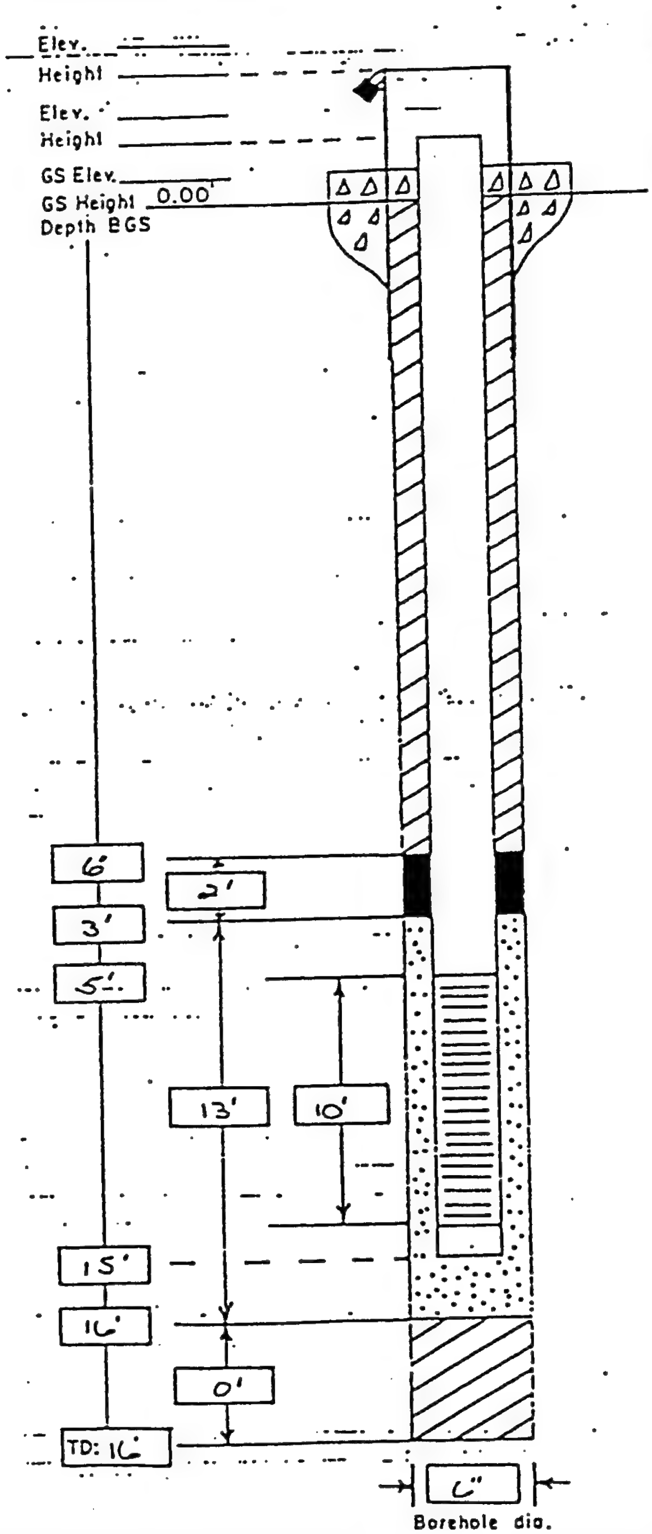
Disposition of discharge water Collected in 55 gal secure drum located next to well.

Time	Volume Removed (gal)	Water Level ft.BTOC	Turbidity	Clarity/ Color	Temp. °C	pH	Conductivity	Remarks
12:20	2.5	17.45	low	brown	60	7.7	800	Allowed to recharge
12:35	2.5	17.45	low	light brown	60	7.9	790	" " "
12:45	2.5	17.45	v. low	brownish clearing	60	7.8	750	" " "
12:50	–	16.08	–	–	–	–	–	
13:00	–	–	–	–	–	–	–	
13:30	–	12:35	–	–	–	–	–	
14:30	–	12.20	–	–	–	–	–	

REV. DATE: JAN 1989

MONITORING WELL CONSTRUCTION LOG - Standard

WELL NO.: MW7	Installation: Rickenbacker ANGB	Site: HWSA
Project No.: CL450.03	Client/Project: RANGB / Hazardous Waste Storage Area	
HAZWRAP Contractor: E-S Inc.	Drlg Contractor: John Mathes & Assoc	
Comp. Start: 1/30/90 (13:00_m)	Comp. End: 1/30/90. (14:10_m)	
Built By: J. Mathes & Assoc	Well Coord.: RA-HW-MW7	



PROTECTIVE CSG
Material/Type Steel
Diameter 4"
Depth BGS 2.5' Weep Hole (Y/N)

GUARD POSTS (Y/N)
No. 3 Type 1/4" Steel Pipe

SURFACE PAD
Composition & Size Cement, 2'x2'x6"

RISER PIPE
Type Sch. 40 PVC
Diameter 2"
Total Length (TOC to TOS) 7'

GROUT
Composition & Proportions 5% Bentonite

Tremied (Y/N)
Interval BGS 0.5'-1.0'

CENTRALIZERS (Y/N)
Depth(s)

SEAL
Type Bentonite Pellets
Source J. Mathes & Assoc
Setup/Hydration time 10 min. Vol. Fluid Added 5 gal.
Tremied (Y/N)

FILTER PACK
Type Silica Sand
Amt Used 200 lbs (4 bags)
Tremied (Y/N)
Source J. Mathes & Assoc
Gr. Size Dist. 20 x 40

SCREEN
Type Sch 40 PVC
Diameter 2"
Slot Size & Type 0.01"
Interval BGS 5'-15'

SUMP (Y/N)
Interval BGS Length
Bottom Cap (Y/N)

BACKFILL PLUG
Material None...
Setup/Hydration time
Tremied (Y/N)

REV. DATE: JAN 1989

WELL DEVELOPMENT LOG

WELL NO.: RB-HW-MW7	Page 1 of 1
Installation: Rickenbacker ANGB	Site: HWSA
Project No.: CL452.03	Client/Project: RANGB / Hazardous Waste Storage Area
HAZWRAP Contractor: E-S Inc.	Dev. Contractor: John Mathes & Assoc.
Dev. Start: 2/2/90 (10 : 50 m)	Dev. End: 2/2/90 (11 : 00 m)
Csg Dia.:	Dev. Rig (Y N)
Developed by: J. Mathes & Assoc. / GOC	

Dev. Method 3L8 Pressure/suction pump, with a 200 gpm pumping ability

Equipment 3L8 suction pump & black neoprene hose (1")

Pre-Dev. SWL 12.45' Maximum drawdown during pumping 6.70 ft at 1.5 gpm

Range and Average discharge rate 1.0-5.0 gpm / 1.5 gpm

Total quantity of material bailed —

Total quantity of water discharged by pumping 15 gal.

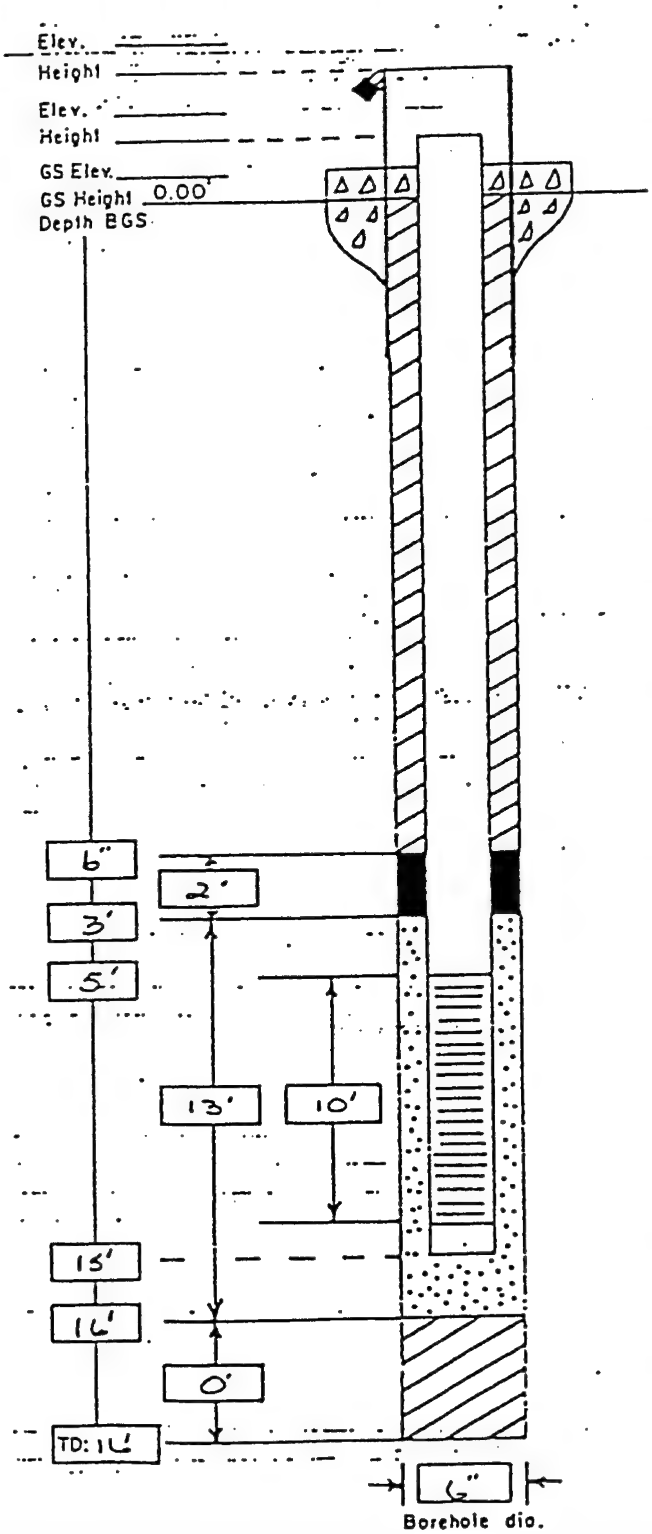
Disposition of discharge water Collected in 55 gal secure drum located next to well

Time	Volume Removed (gal)	Water Level ft.BTOC	Turbidity	Clarity/ Color	Temp. °C	pH	Conductivity	Remarks
10:50	5	19.15	low	brown	62	7.4	740	
10:55	5	19.15	v. low	light brown	59	8.0	740	Clearing
11:00	5	19.15	—	clear	58	8.0	760	Clear
11:05	—	15.00	-	-	—	—	—	
12:05	—	12.65	—	—	-	—	-	
13:00	—	12.55	—	—	-	—	—	

REV. DATE: JAN 1989

MONITORING WELL CONSTRUCTION LOG - Standard

WELL NO.: MW8	Installation: Rickenbacker ANGB	Site: HWSA
Project No.: CL452.03	Client/Project: RANGB/ Hazardous Waste Storage Area	
HAZWRAP Contractor: E-S Inc.	Drlg Contractor: John Mathes & Assoc	
Comp. Start: 1/30/90 (15:00 m)	Comp. End: 1/30/90. (16:30 m)	
Built By: J. Mathes & Assoc	Well Coord.: RB-HW-MW8	



PROTECTIVE CSG
Material/Type: Steel
Diameter: 4"
Depth BGS: 2.5' Weep Hole (Y/N)

GUARD POSTS (Y/N) Y
No.: 3 Type: 1/4" Steel Pipe

SURFACE PAD
Composition & Size: Cement, 2'x2'x6"

RISER PIPE
Type: Sch 40 PVC
Diameter: 2"
Total Length (TOC to TOS): 8'

GROUT
Composition & Proportions: 5% Bentonite

Tremied (Y/N) N
Interval BGS: 0.5'-1.0'

CENTRALIZERS (Y/N) N
Depth(s):

SEAL
Type: Bentonite Pellets
Source: J. Mathes & Assoc.
Setup/Hydration time: 10 min Vol. Fluid Added:
Tremied (Y/N)

FILTER PACK
Type: Silica Sand
Amt Used: 150 lbs. (3 bags)
Tremied (Y/N) N
Source: J. Mathes & Assoc
Gr. Size Dist.: 20 x 40

SCREEN
Type: Sch 40 PVC
Diameter: 2"
Slot Size & Type: 0.01"
Interval BGS: 5'-15'

SUMP (Y/N) N
Interval BGS: Length:
Bottom Cap (Y/N)

BACKFILL PLUG
Material: None...
Setup/Hydration time:
Tremied (Y/N)

WELL DEVELOPMENT LOG

WELL NO.: RB-HW-MW8 | Page 1 of 1

Installation: Rickenbacker ANGB | Site: HWSA

Project No.: 6452.03 | Client/Project: RANGB / Hazardous Waste Storage Area

HAZWRAP Contractor: E-S Inc. | Dev. Contractor: John Mathes & Assoc

Dev. Start: 2/2/90 (9: 50 m) | Dev. End: 2/2/90 (10 : 25 m) | Csg Dia.:

Developed by: J. Mathes & Assoc / GOC | Dev. Rig (Y/ N) Y

Dev. Method 3L8 Pressure / suction pump, with a 200 gpm pumping ability.

Equipment 3L8 suction pump & black neoprene hose (1")

Pre-Dev. SWL 8.40' Maximum drawdown during pumping 9.80 ft at 0.43 gpm

Range and Average discharge rate 0.33 - 5.0 gpm / 0.43 gpm

Total quantity of material bailed –

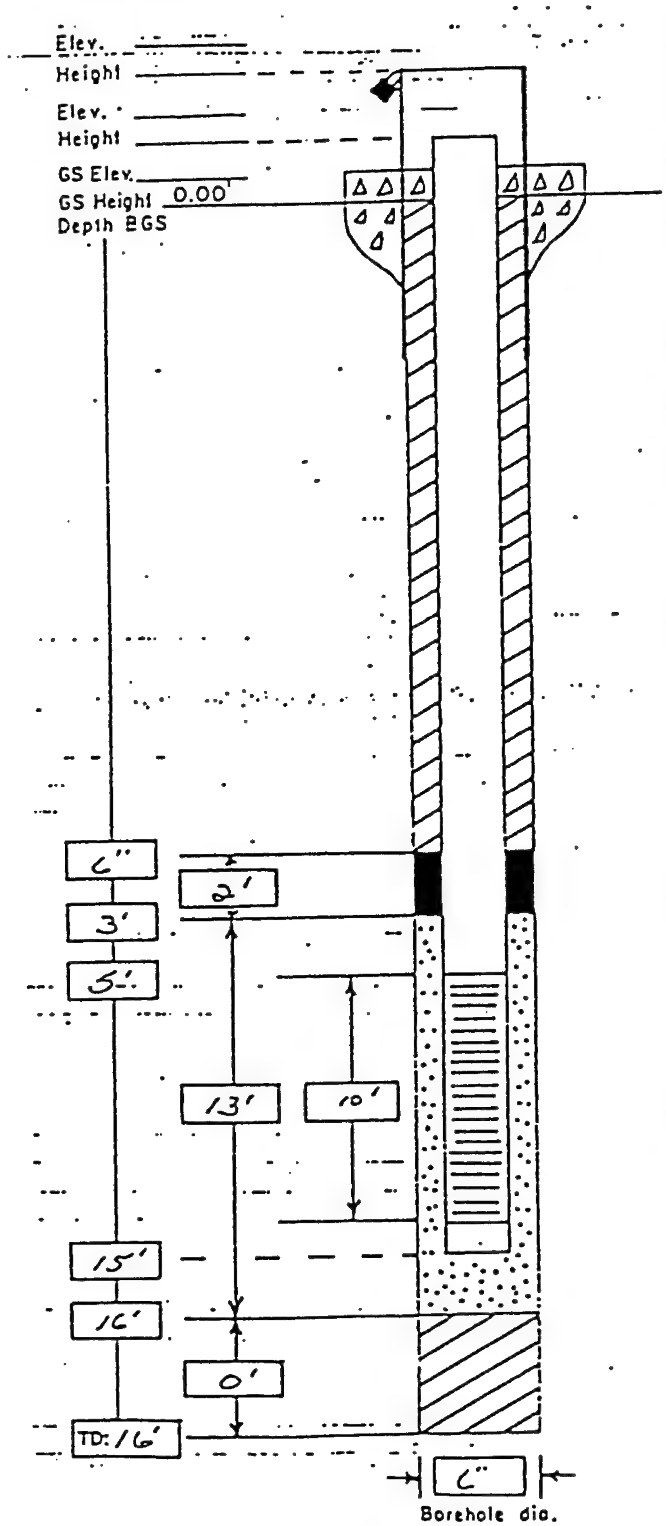
Total quantity of water discharged by pumping 15 gal

Disposition of discharge water Collected in 55 gal. secure drum located next to well

Time	Volume Removed (gal)	Water Level ft.BTOC	Turbidity	Clarity/ Color	Temp. °C	pH	Conductivity	Remarks
9:50	5	18.20	low	brown	50	7.8	710	
10:10	5	18.20	v. low	light brown	51	8.1	620	
10:25	5	18.20	v. low	clearing brown	57	7.9	620	
10:35	–	14.35	–	–	–	–	–	
11:00	–	11.60	–	–	–	–	–	
12:05	–	10.73	–	–	–	–	–	
13:00	–	10.55	–	–	–	–	–	
14:30	–	10.53	–	–	–	–	–	

MONITORING WELL CONSTRUCTION LOG - Standard

WELL NO.: MW 9	Installation: Rickenbacker ANGB	Site: HWSA
Project No.: CC45203	Client/Project: RANGB/ Hazardous Waste Storage Area	
HAZWRAP Contractor: E-S Inc.	Drlg Contractor: John Mathes & Assoc.	
Comp. Start: 2/9/90 (9: 40 m)	Comp. End: 2/9/90. (11 : 00 m)	
Built By: J. Mathes & Assoc.	Well Coord.: RB-HW-MW19	



PROTECTIVE CSG
Material/Type Steel/-
Diameter 4"
Depth BGS 2.5' Weep Hole (Y/N)

GUARD POSTS (Y/N)
No. 3 Type 1/4" Steel Pipe

SURFACE PAD
Composition & Size Cement 2'x2'x6"

RISER PIPE
Type Sch. 40 PVC
Diameter 2"
Total Length (TOC to TOS) 8'

GROUT
Composition & Proportions 5% Bentonite

Tremied (Y/N)
Interval BGS 0.5'-1.0'

CENTRALIZERS (Y/N)
Depth(s).

SEAL
Type Bentonite Pellets
Source J. Mathes & Assoc.
Setup/Hydration time 10 min. Vol. Fluid Added 5 gal
Tremied (Y/N)

FILTER PACK
Type Silica Sand
Amt Used 200 lbs (4 bags
Tremied (Y/N)
Source J. Mathes & Assoc
Gr. Size Dist. 20 x 40

SCREEN
Type Sch. 40 PVC
Diameter 2"
Slot Size & Type 0.01"
Interval BGS 5'-15'

SUMP (Y/N)
Interval BGS Length
Bottom Cap (Y/N)

BACKFILL PLUG
Material None...
Setup/Hydration time
Tremied (Y/N)

REV. DATE: JAN 1990

WELL DEVELOPMENT LOG

WELL NO.: RB-HW-MW9	Page 1 of 1
Installation: Rickenbacker ANGB	Site: HWSA
Project No.: CL452.03	Client/Project: RANGB / Hazardous Waste Storage Area
HAZWRAP Contractor: E-S Inc.	Dev. Contractor: John Mathes & Assoc.
Dev. Start: 2/9/90 (13:00 m)	Dev. End: 2/9/90 (13:20 m)
Csg Dia.:	Dev. Rig (Y/N)
Developed by: J. Mathes & Assoc. / GOC	

Dev. Method: Manual 2" Teflon bailer

Equipment: 2" teflon bailer with

Pre-Dev. SWL: 17.05' Maximum drawdown during pumping: 1.15 ft at 0.10 gpm

Range and Average discharge rate: 0.1-0.25 gpm / 0.1 gpm

Total quantity of material bailed: 2 gal.

Total quantity of water discharged by pumping: —

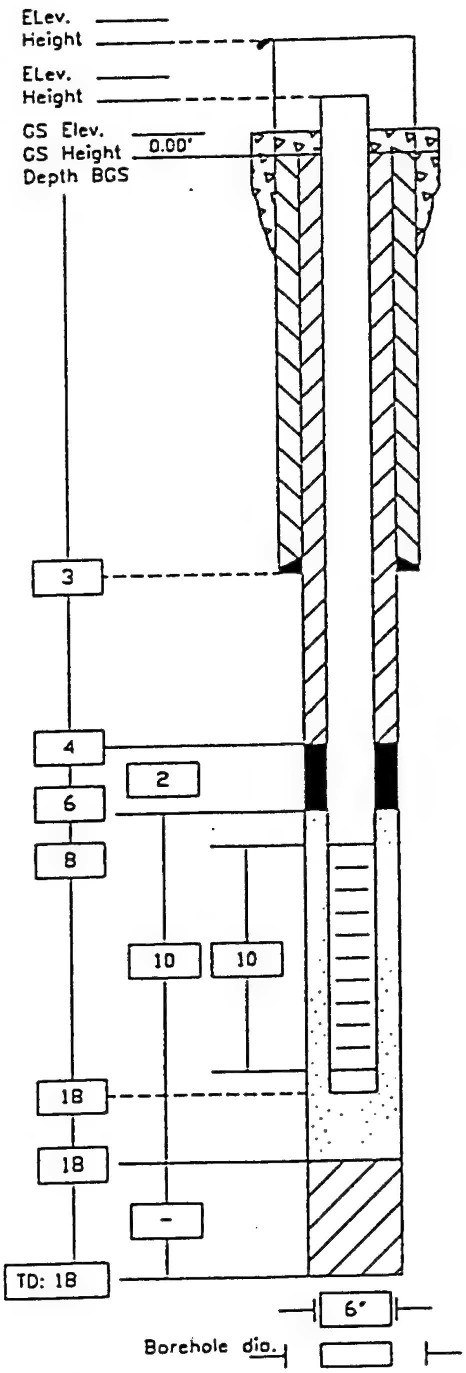
Disposition of discharge water: Collected in 55 gal. secure drum located next to well

Time	Volume Removed (gal)	Water Level ft.BTOC	Turbidity	Clarity/Color	Temp. °C	pH	Conductivity	Remarks
13:00	0.25	18.15	v. low	Clear	54	7.2	840	
13:05	1.0	18.15	—	"	53	7.3	950	
13:20	2.0	18.15	—	"	52	7.5	910	
13:25	—	17.90		—	—	—	—	
14:05	—	17.63		—	—	—	—	

FIGURE 4.2

REV. DATE: JAN 1989

MONITORING WELL CONSTRUCTION LOG – Double Cased		
WELL NO.: MW-10	Installation: RICKENBACKER ANGB	Site: HWSA-560
project No.: CL115.40	Client/Project: HAZWRAP	
HAZWRAP Contractor: ENGINEERING-SCIENCE	Drlg Contractor: MATHES & ASSOC.	
Comp. Start: 10/14/91 (11:30 A m)	Comp. End: 10/14/91 (13:55 Pm)	
Built By:	Well Coord:	



PROTECTIVE CSG
Material/Type STEEL
Diameter 4"
Depth BGS 3' Weep Hole (Y/N) — N circled

GUARD POSTS (Y/N) — Y circled
No. 3 Type STEEL

SURFACE PAD
Composition & Size 2'x2' CONCRETE

SURFACE CSG
Type
Diameter Total length
GROUT: Setup/Hydration Time
Composition & Proportions
Interval BGS
Tremied (Y/N)

RISER PIPE
Type SCH 40 PVC
Diameter 2"
Total Length (TOC to TOS) 11'
GROUT
Composition & Proportions
Interval BGS 0-4' BGS
Tremied (Y/N) — N circled

CENTRALIZERS (Y/N) — N circled
Depth(s)

SEAL
Type
Source
Setup/Hydration Time Vol. Fluid Added
Tremied (Y/N)

FILTER PACK
Type WASH OTTAWA SANDS
Amount Used 3 BAGS
Source
Gr. Size Dist
Tremied (Y/N) — N circled

SCREEN
Type SCH 40 PVC
Diameter 2"
Slot Size & Type 0.010"

SUMP (Y/N) — N circled
Interval BGS Length
Bottom Cap (Y/N) — Y circled

BACKFILL PLUG
Material
Setup/Hydration Time
Tremied (Y/N)

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CL115.40.03

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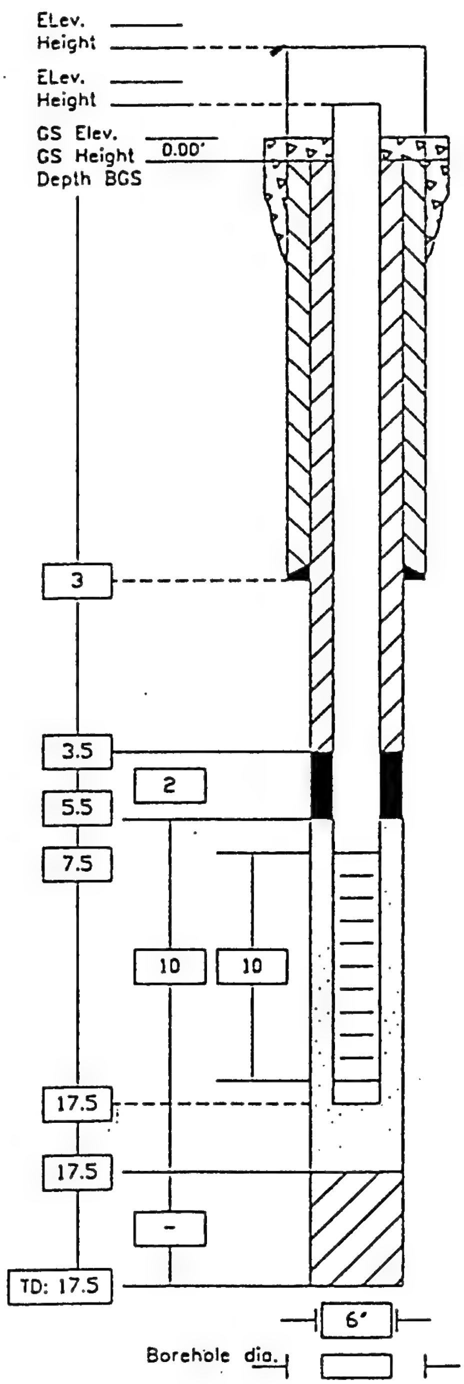
FIGURE 4.2

REV. DATE: JAN 1989

MONITORING WELL CONSTRUCTION LOG – Double Cased		
WELL NO.: MW-11	Installation: RICKENBACKER ANGB	Site: HWSA-560
project No.: CL115.40	Client/Project: HAZWRAP	
HAZWRAP Contractor: ENGINEERING-SCIENCE	Drlg Contractor: MATHES & ASSOC.	
Comp. Start: 10/15/91 (10:30 A m)	Comp. End: 10/15/91 (13:30 Pm)	
Built By:	Well Coord:	



PROTECTIVE CSG
Material/Type STEEL
Diameter 4"
Depth BGS 3' Weep Hole (Y/N) — N circled

GUARD POSTS (Y/N) — Y circled
No. 3 Type STEEL

SURFACE PAD
Composition & Size 2'x2' CONCRETE

SURFACE CSG
Type
Diameter Total length
GROUT: Setup/Hydration Time
Composition & Proportions
Interval BGS
Tremied (Y/N)

RISER PIPE
Type SCH 40 PVC
Diameter 2"
Total Length (TOC to TOS) 10.5
GROUT
Composition & Proportions
Interval BGS
Tremied (Y/N) — N circled

CENTRALIZERS (Y/N)
Depth(s)

SEAL
Type 1/4" BENTONITE PELLETS
Source WYOMING
Setup/Hydration Time Vol. Fluid Added 2 GALLONS
Tremied (Y/N) — N circled

FILTER PACK
Type OTTAWA WASHED SANDS
Amount Used 3 BAGS
Source
Gr. Size Dist
Tremied (Y/N)

SCREEN
Type SCH 40 PVC
Diameter 2"
Slot Size & Type 0.010"

SUMP (Y/N) — N circled
Interval BGS Length
Bottom Cap (Y/N)

BACKFILL PLUG
Material
Setup/Hydration Time
Tremied (Y/N) — N circled

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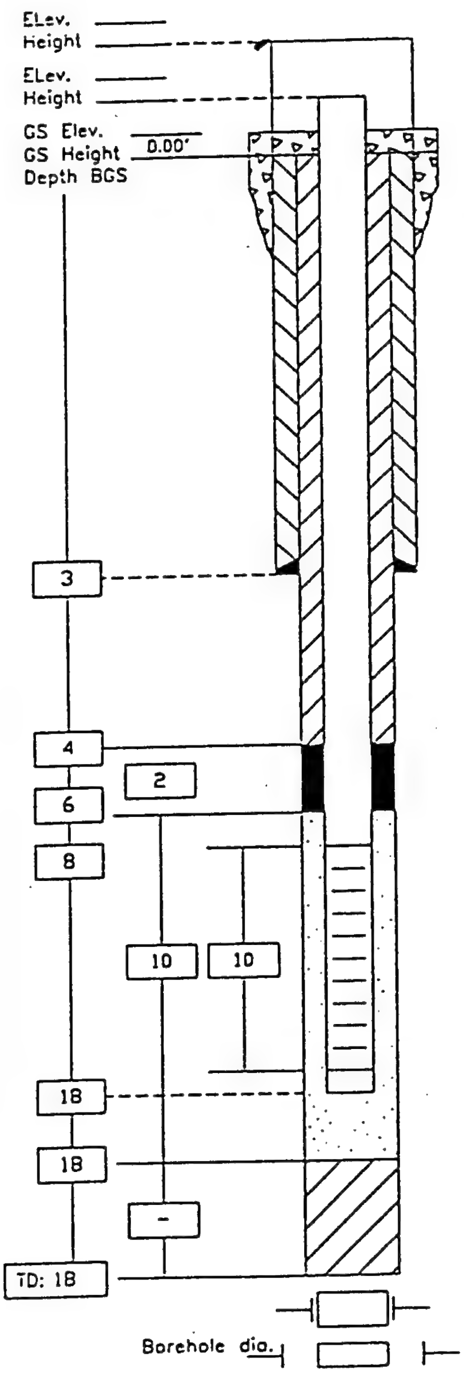
FIGURE 4.2

REV. DATE: JAN 1989

MONITORING WELL CONSTRUCTION LOG – Double Cased		
WELL NO.: MW-12	Installation: RICKENBACKER ANGB	Site: HWSA-560
project No.: CL115.40	Client/Project: HAZWRAP	
HAZWRAP Contractor: ENGINEERING-SCIENCE	Drlg Contractor: MATHES & ASSOC.	
Comp. Start: 10/15/91 (15:00 P m)	Comp. End: 10/16/91 (11:00 A m)	
Built By:	Well Coord:	



PROTECTIVE CSG
Material/Type STEEL
Diameter 4'
Depth BGS 3' Weep Hole (Y/N)

GUARD POSTS (Y/N)
No. 3 Type STEEL

SURFACE PAD
Composition & Size 2'x2' CONCRETE

SURFACE CSG
Type
Diameter Total length
GROUT: Setup/Hydration Time
Composition & Proportions
Interval BGS
Tremied (Y/N)

RISER PIPE
Type SCH 40 PVC
Diameter 2'
Total Length (TOC to TOS) 11'
GROUT
Composition & Proportions
Interval BGS
Tremied (Y/N)

CENTRALIZERS (Y/N)
Depth(s)

SEAL
Type BENTONITE PELLETS
Source WYOMING
Setup/Hydration Time Vol. Fluid Added 2 GALLONS
Tremied (Y/N)

FILTER PACK
Type OTTAWA SANDS
Amount Used 3 BAGS
Source
Gr. Size Dist
Tremied (Y/N)

SCREEN
Type SCH 40 PVC
Diameter 2'
Slot Size & Type 0.010'

SUMP (Y/N)
Interval BGS Length
Bottom Cap (Y/N)

BACKFILL PLUG
Material
Setup/Hydration Time
Tremied (Y/N)

0115W128

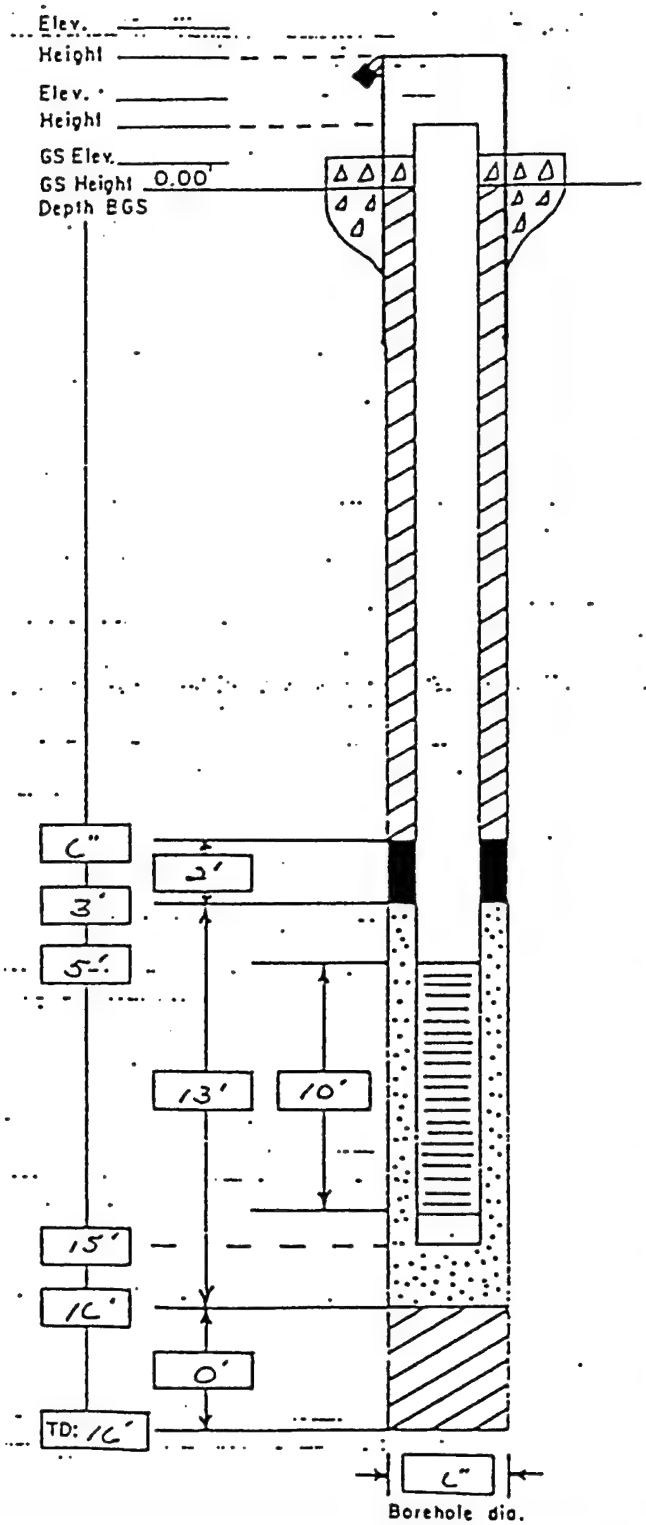
CL115.40.03

ES ENGINEERING-SCIENCE

REV. DATE: JAN 1989

MONITORING WELL CONSTRUCTION LOG - Standard

WELL NO.: MW4	Installation: Rickenbacker ANGB	Site: HWSA
Project No.: CL450.03	Client/Project: RANGB/ Hazardous Waste Storage Area	
HAZWRAP Contractor: E-S Inc.	Drlg Contractor: John Mathes & Assoc.	
Comp. Start: 1/29/90 (13:35 m)	Comp. End: 1/29/90 (15:00 m)	
Built By: J. Mathes & Assoc. / GOC	Well Coord.: RB-HW-MW4	



PROTECTIVE CSG
Material/Type: Steel
Diameter: 4"
Depth BGS: 2.5' Weep Hole (Y/N): N

GUARD POSTS (Y/N): Y
No.: 3 Type: 1/4" Steel Pipe

SURFACE PAD
Composition & Size: Cement, 2'x2'x6"

RISER PIPE
Type: Sch. 40 PVC
Diameter: 2"
Total Length (TOC to TOS): 8'

GROUT
Composition & Proportions: 5% Bentonite

Tremied (Y/N): N
Interval BGS: 0.5'-1.0'

CENTRALIZERS (Y/N): N
Depth(s):

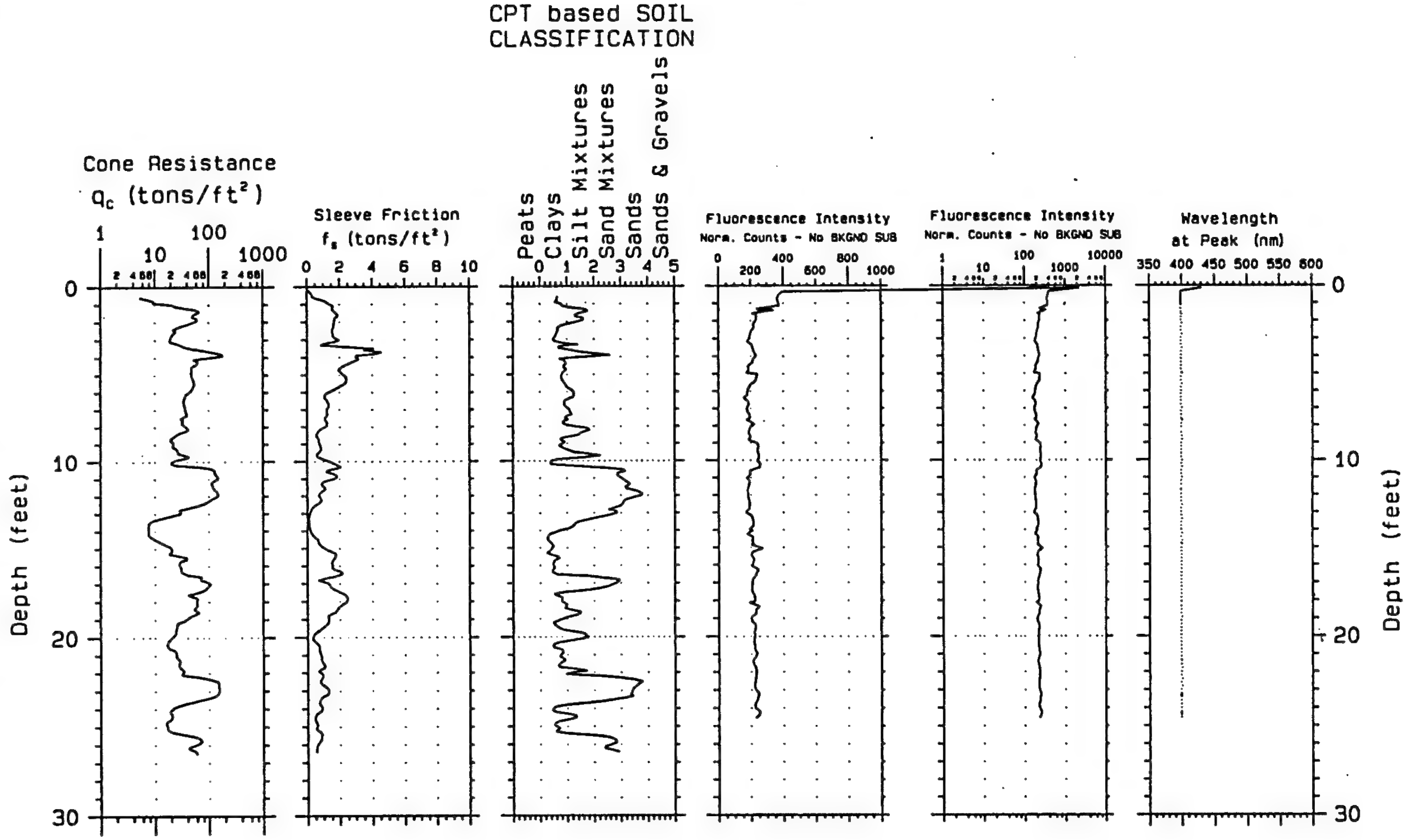
SEAL
Type: Bentonite Pellets
Source: J. Mathes & Assoc
Setup/Hydration time: 10min Vol. Fluid Added: 5 gal
Tremied (Y/N): N

FILTER PACK
Type: Silica Sand
Amt Used: 200 lbs. (4 bags)
Tremied (Y/N): N
Source: J. Mathes & Assoc.
Gr. Size Dist.: 20x40

SCREEN
Type: Sch. 40 PVC
Diameter: 2"
Slot Size & Type: 0.01"
Interval BGS: 5'-15'

SUMP (Y/N): N
Interval BGS: Length:
Bottom Cap (Y/N)

BACKFILL PLUG
Material: None
Setup/Hydration time:
Tremied (Y/N)



LIF 1

Project; Rickenbacker ANG
Probe Depth; 26.70

Laser induced fluorescence of POL via fiber optics

U.S.Army Engineer District Kansas City Geotechnical Branch

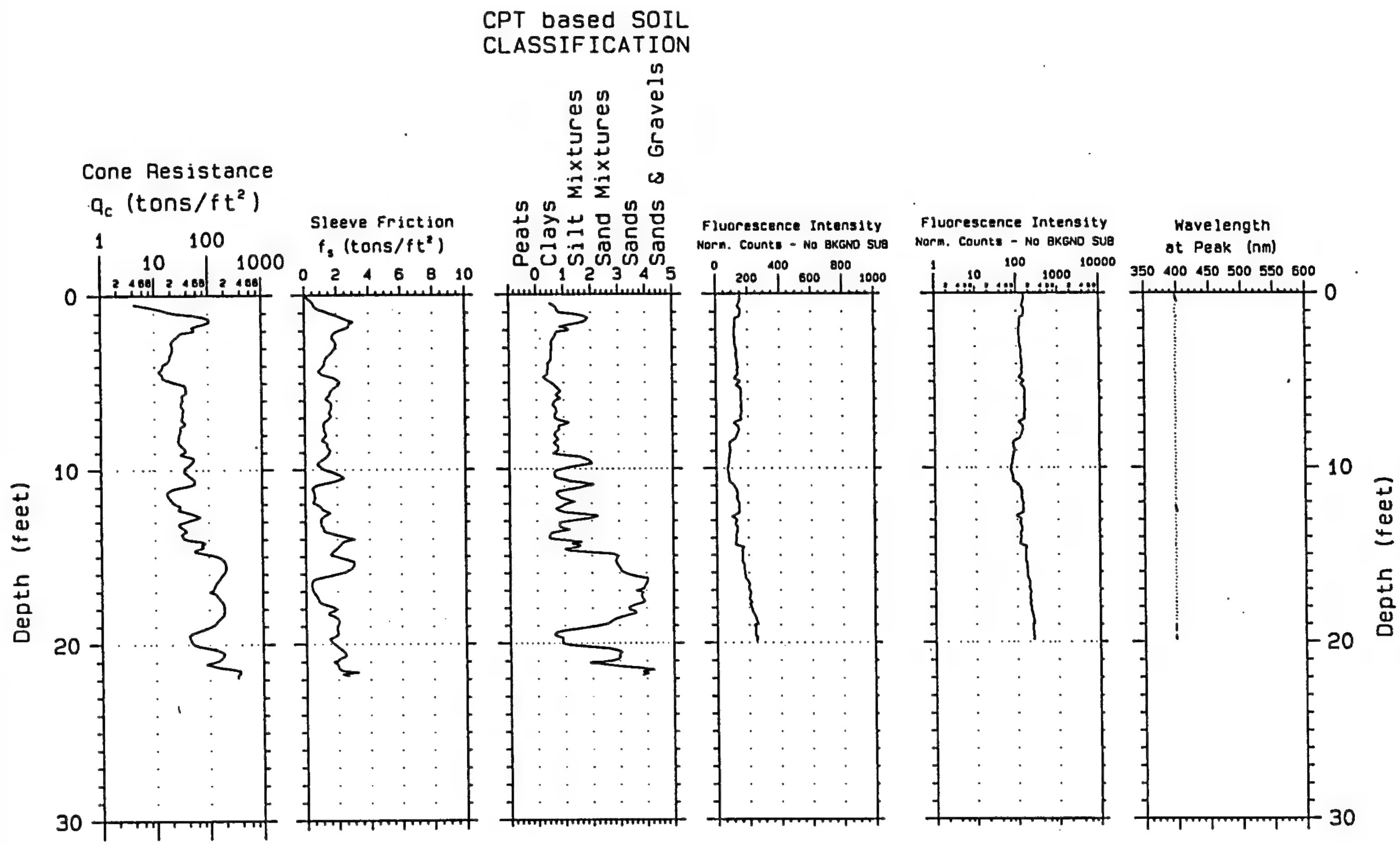
SCAPS

Site Characterization and Analysis Penetrometer System

CPT; 2RKRF1

Probing date; 02-21-1995

Nearest MP: ESMP 5S @ 12.51'
ESMP-5D @ 22.5



LIF 2

Project; Rickenbacker ANG

Probe Depth; 22.07

Laser induced fluorescence of POL via fiber optics

U.S.Army Engineer District Kansas City Geotechnical Branch

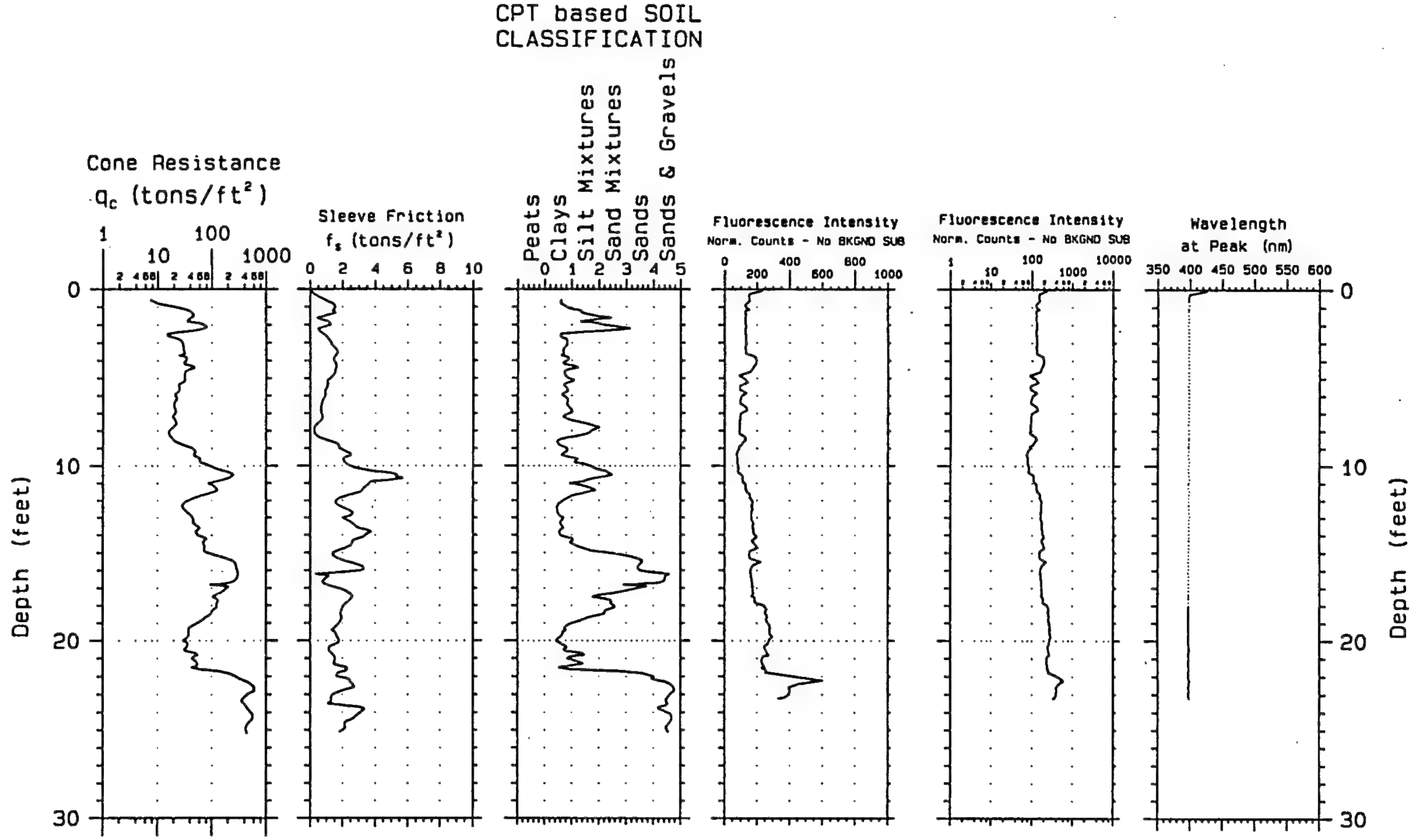
SCAPS

Site Characterization and Analysis Penetrometer System

CPT; 3RKRF1

Probing date; 02-21-1995

ES 35 - 9.74



L1F3

Laser induced fluorescence of POL via fiber optics

U.S.Army Engineer District Kansas City Geotechnical Branch

Probing date; 02-21-1995

SCAPS

Site Characterization and Analysis Penetrometer System

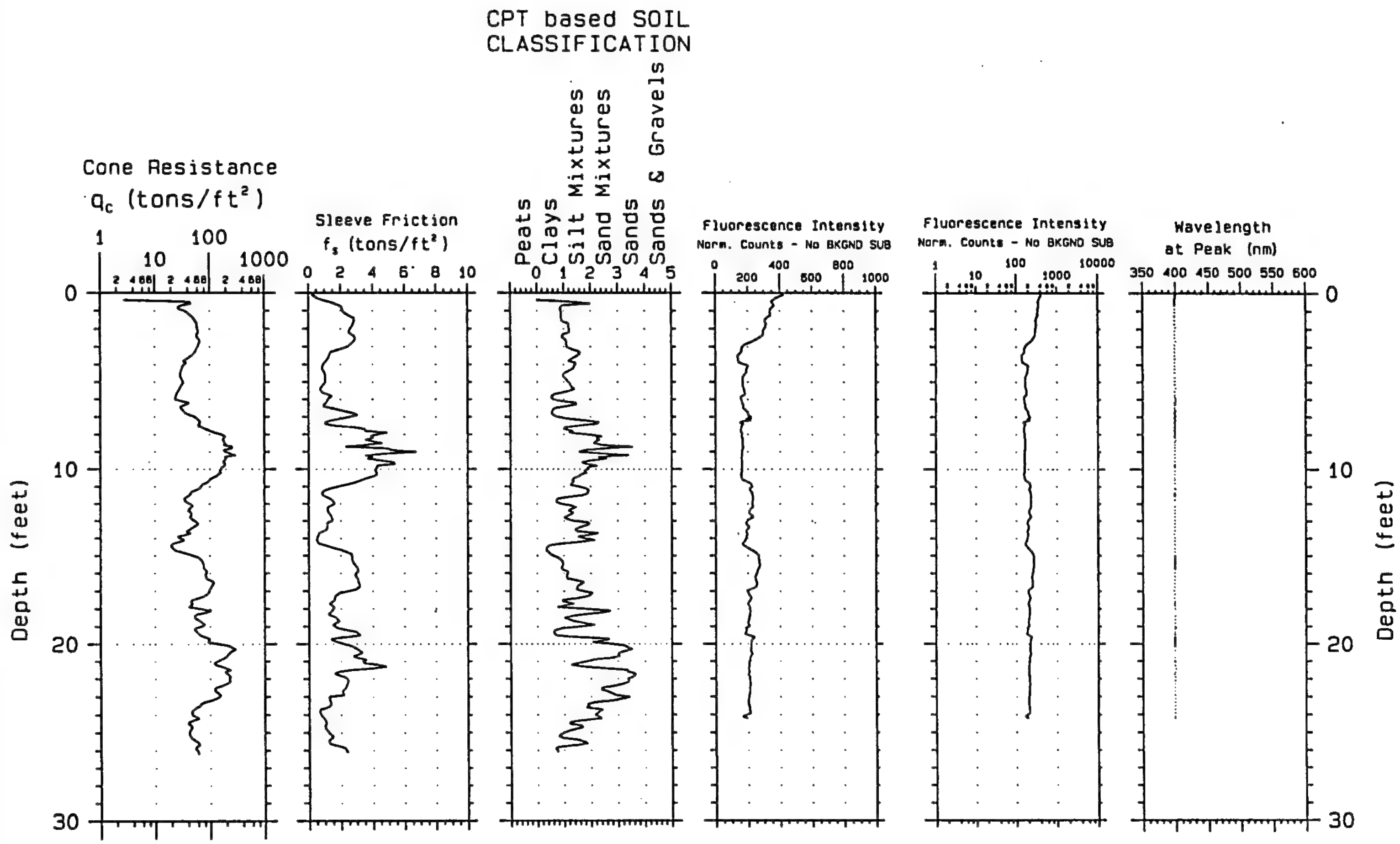
Project; Rickenbacker ANG

Probe Depth; 25.40

CPT; 4RKRF1

ESMP-6S 15.8

ESMP-6D 23.5



LIF 4

Laser induced fluorescence of POL via fiber optics

U.S.Army Engineer District Kansas City Geotechnical Branch

Project; Rickenbacker ANG

Probe Depth; 26.35

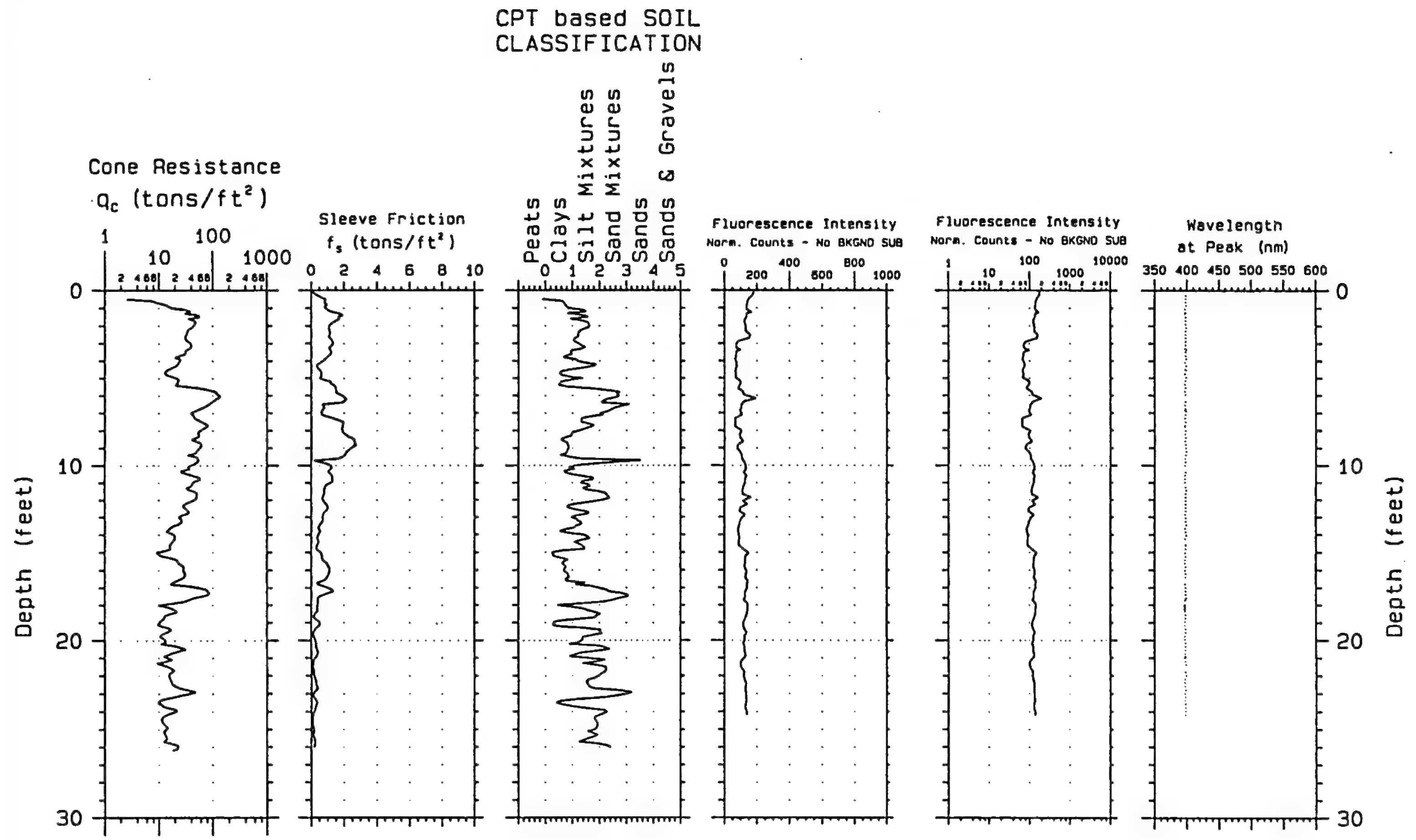
SCAPS

Site Characterization and Analysis Penetrometer System

CPT; 6RKRE1

Probing date: 02-22-1995

ESMP-75 11.75

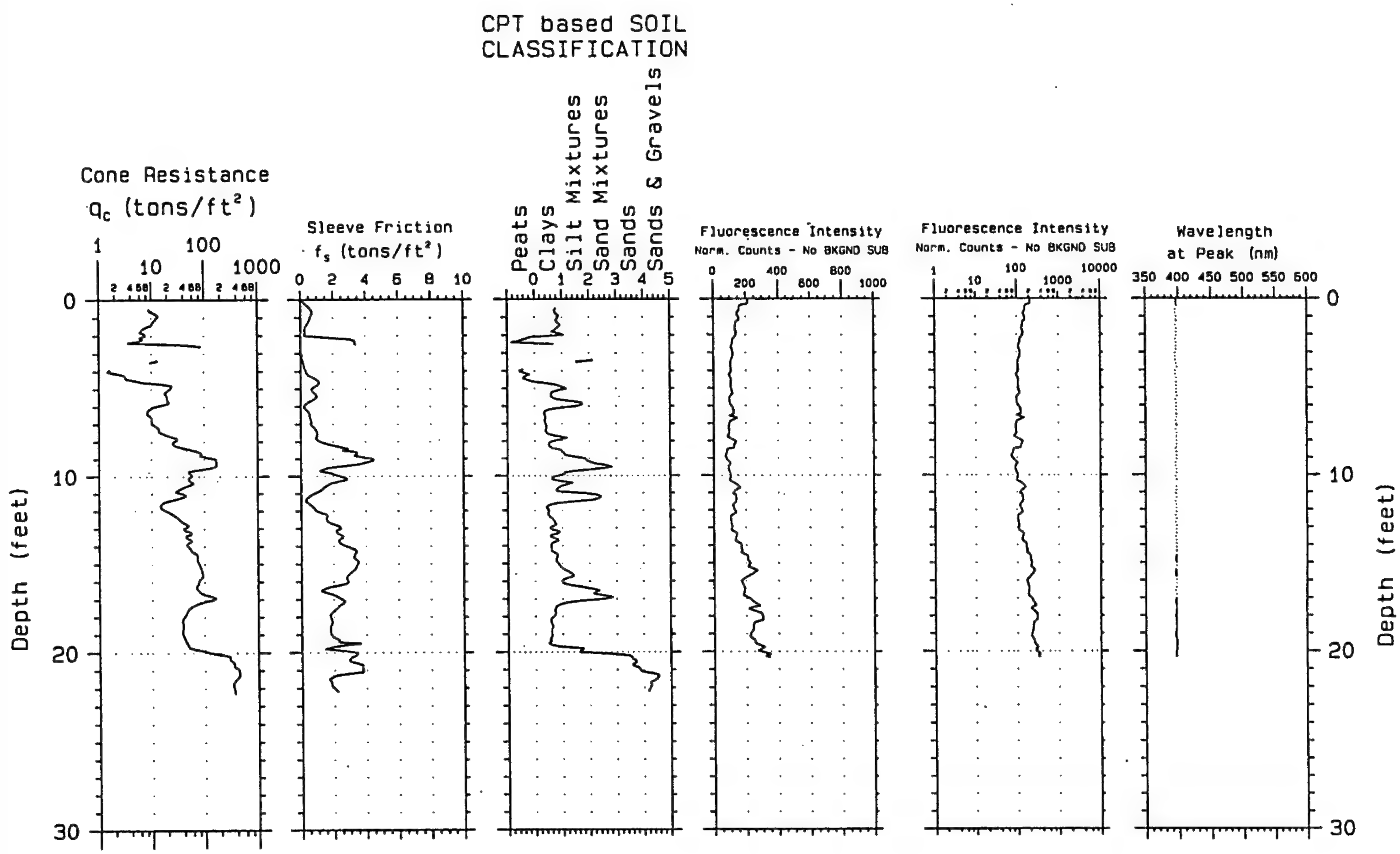


LIF 5

Probing date; 02-22-1995	Laser induced fluorescence of POL via fiber optics U.S.Army Engineer District Kansas City Geotechnical Branch	Project; Rickenbacker ANG Probe Depth; 26.32
	SCAPS	Site Characterization and Analysis Penetrometer System CPT; 7RKRF1

ESMP- 11S 15.78

ESMP- 11D 22.82



LIF 6

Laser induced fluorescence of POL via fiber optics

U.S.Army Engineer District Kansas City Geotechnical Branch

Probing date: 02-22-1995

SCAPS

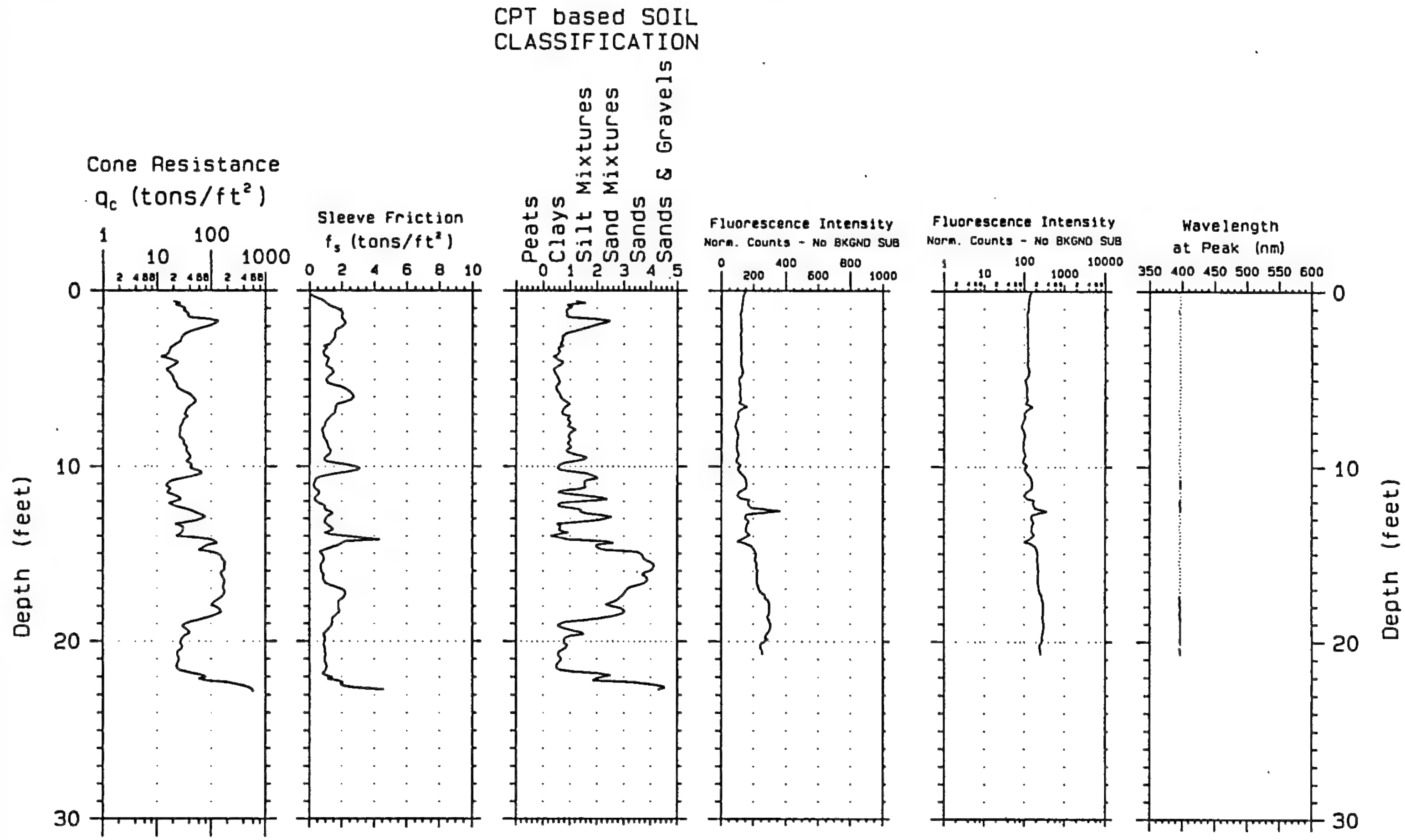
Site Characterization and Analysis Penetrometer System

Project; Rickenbacker ANG

Probe Depth; 22.48

CPT; 8RKRF1

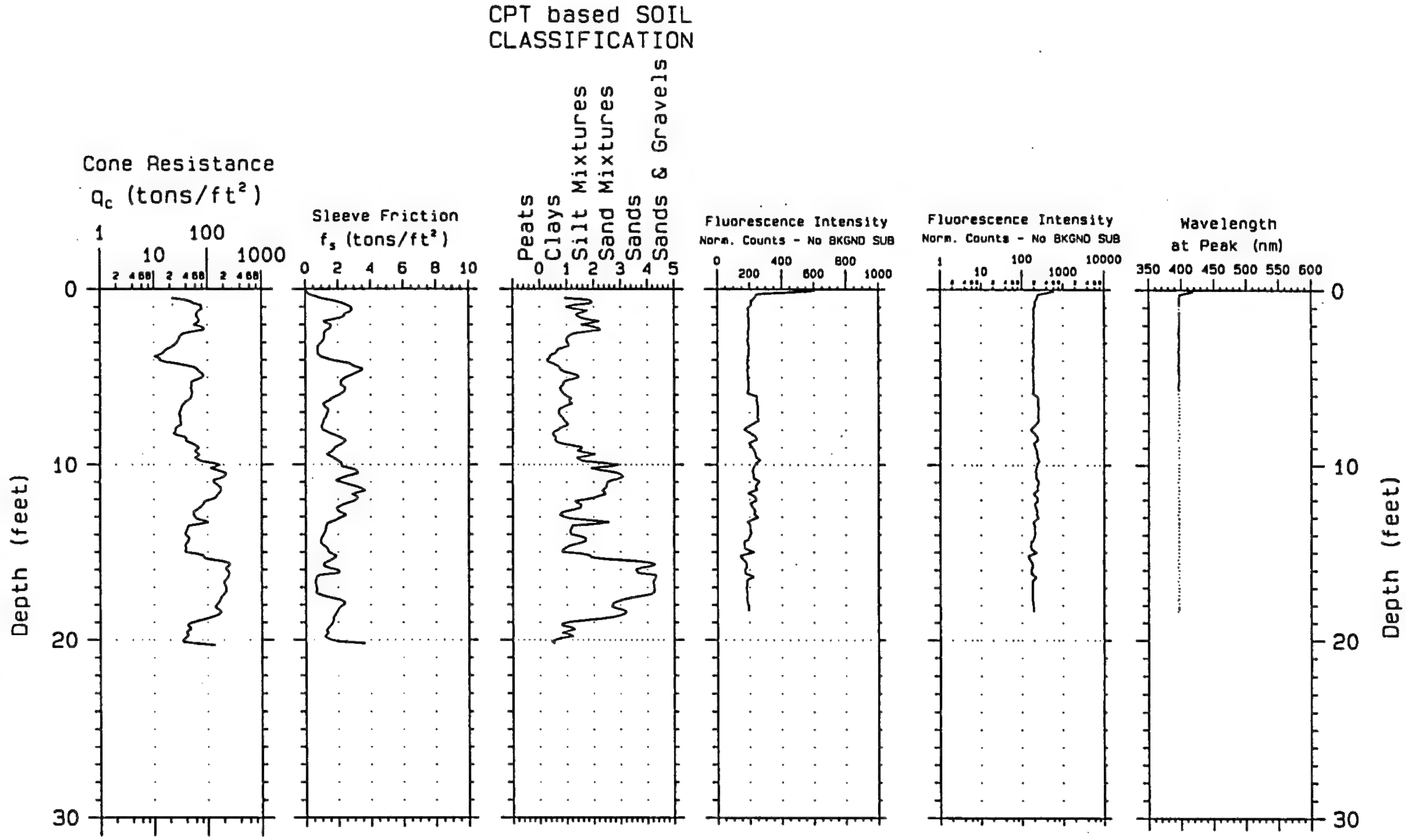
between ESMP-11



LIF 7

Probing date; 02-22-1995	Laser induced fluorescence of POL via fiber optics U.S.Army Engineer District Kansas City Geotechnical Branch	Project; Rickenbacker ANG Probe Depth; 22.95
	SCAPS	Site Characterization and Analysis Penetrometer System **CPT; 9RKRF1**

ESMP-4S 12.58
ESMP-4D 22.54



LIF 8

Laser induced fluorescence of POL via fiber optics

U.S.Army Engineer District Kansas City Geotechnical Branch

Probing date; 02-22-1995

SCAPS

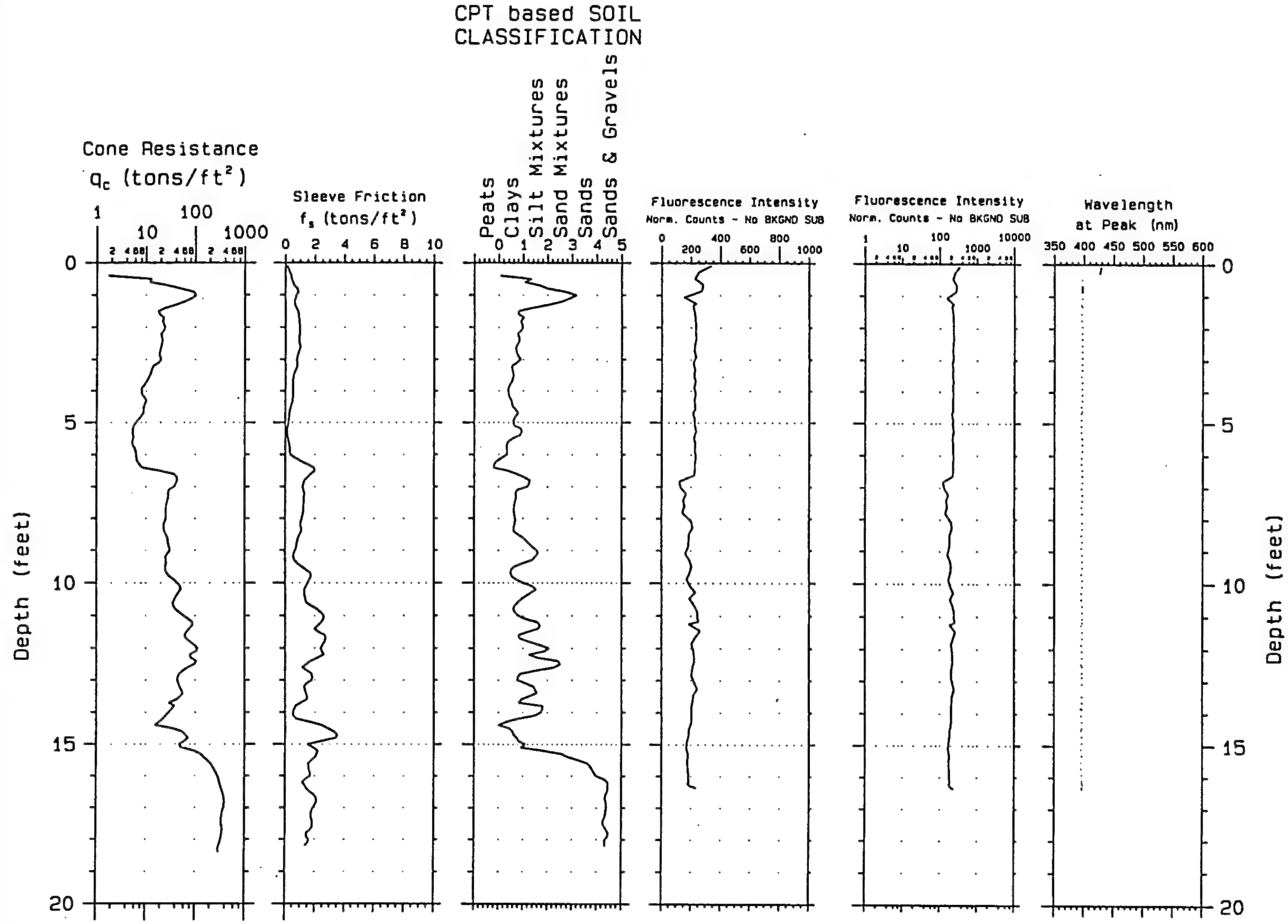
Site Characterization and Analysis Penetrometer System

Project; Rickenbacker ANG

Probe Depth; 20.48

CPT; 10RKRF1

ESMP-1S 11.7



LIF 9

Laser induced fluorescence of POL via fiber optics

U.S. Army Engineer District Kansas City Geotechnical Branch

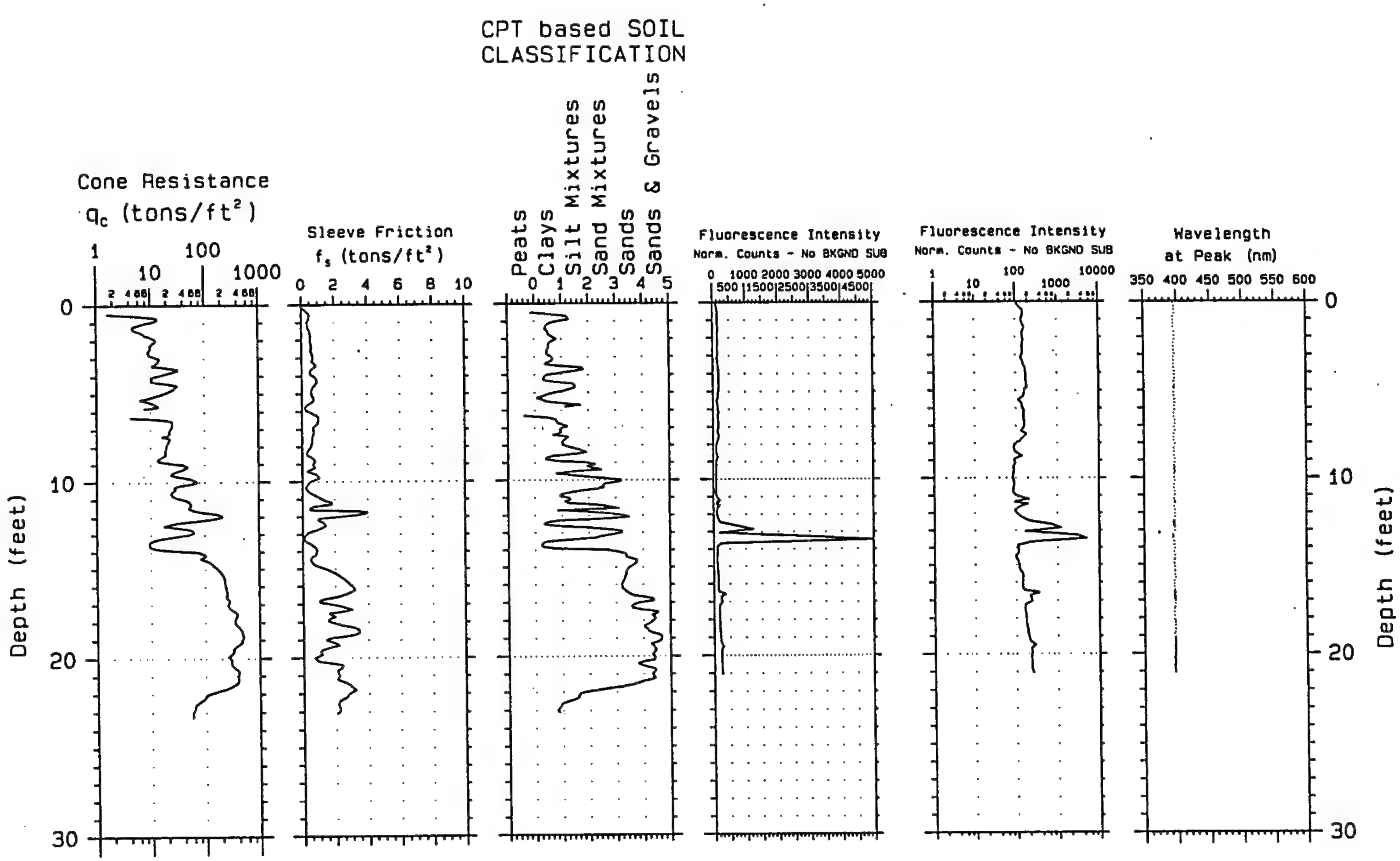
Project; Rickenbacker ANG

Probe Depth; 18.55

SCAPS Site Characterization and Analysis Penetrometer System

CPT; 11RKRF1

Probing date; 02-22-1995



LIF II

Laser induced fluorescence of POL via fiber optics

U.S. Army Engineer District Kansas City Geotechnical Branch

Probing date: 02-22-1995

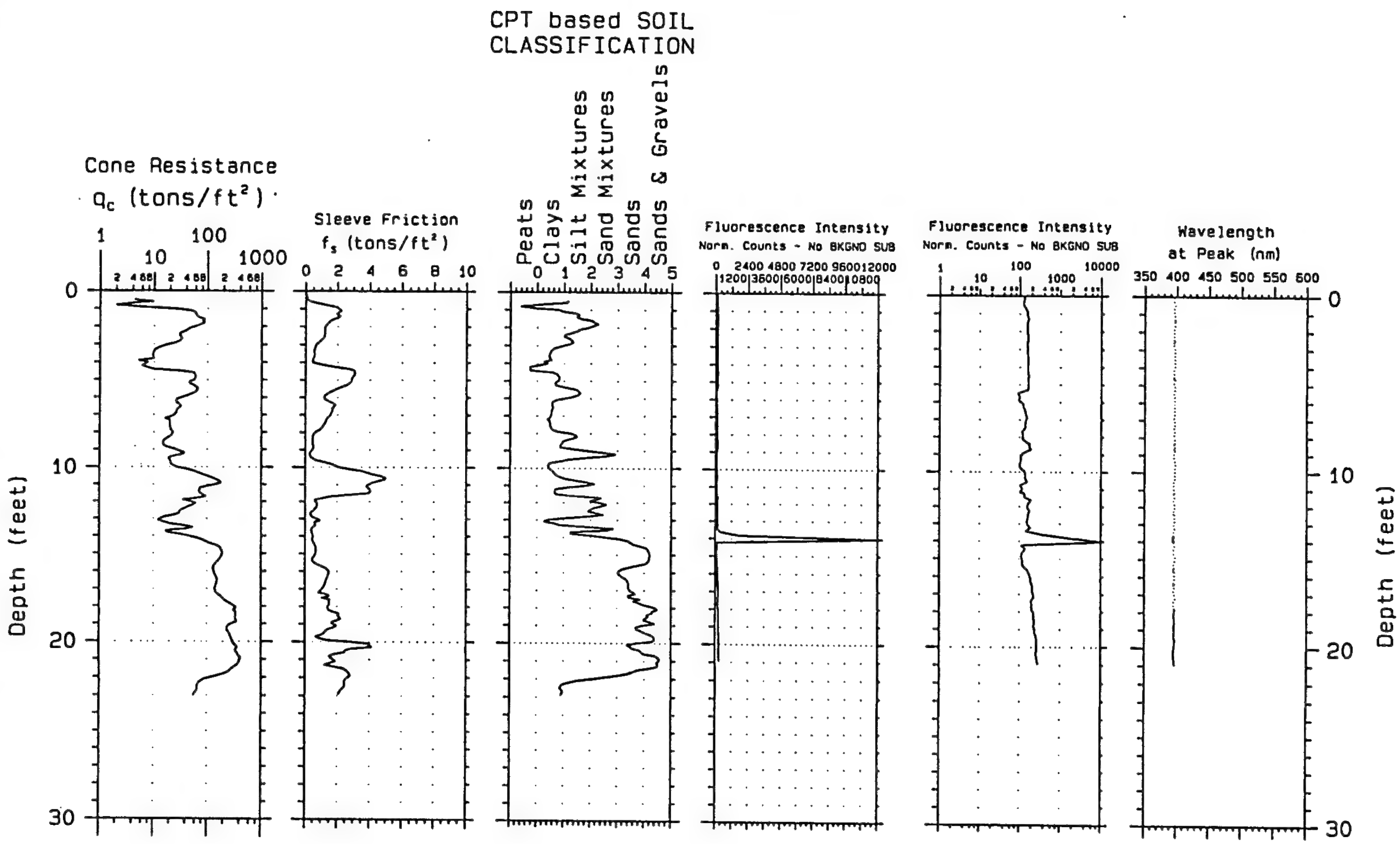
SCAPS

Site Characterization and Analysis Penetrometer System

Project; Rickenbacker ANG

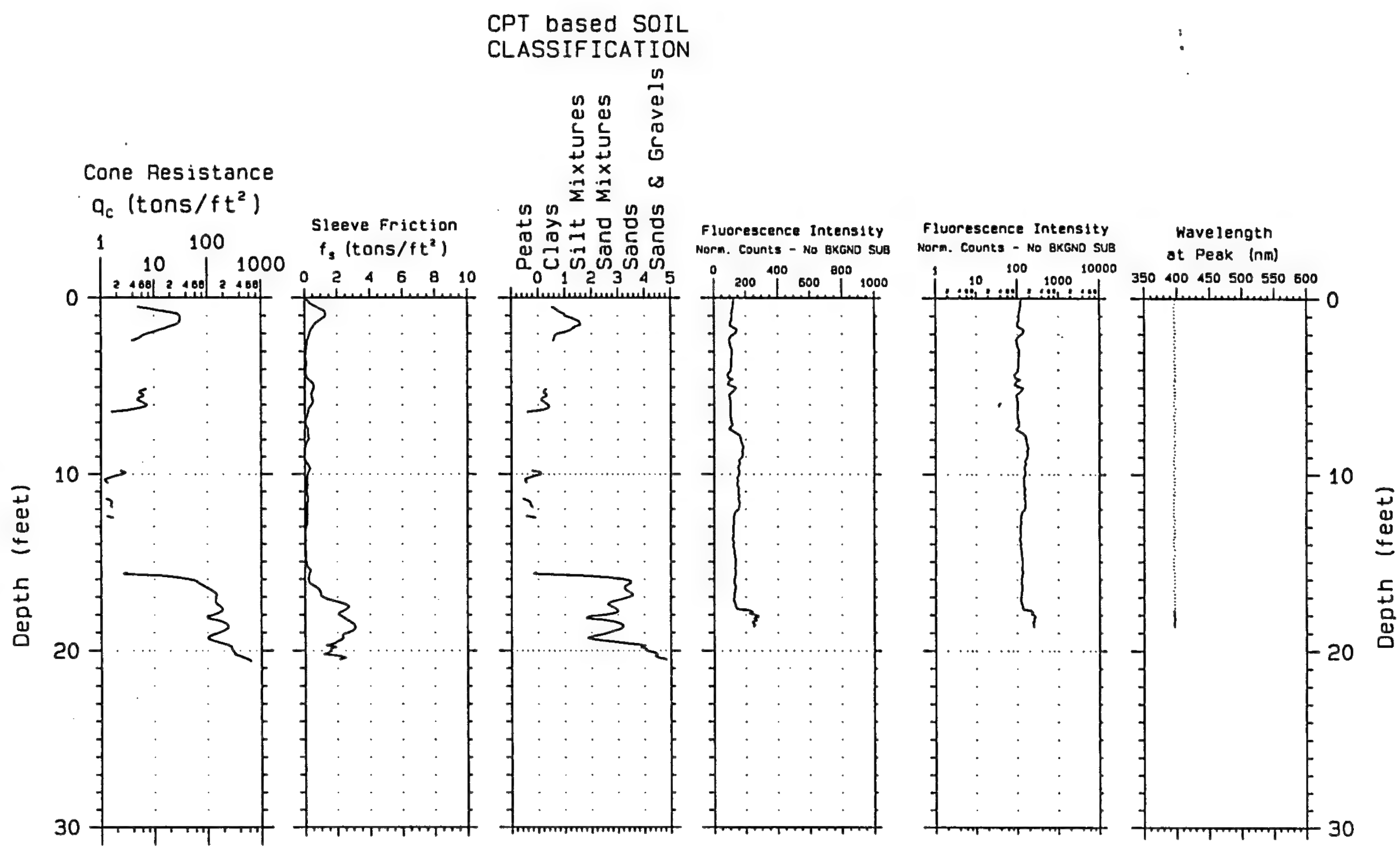
Probe Depth; 23.40

CPT; 13RKRF1



LIF12

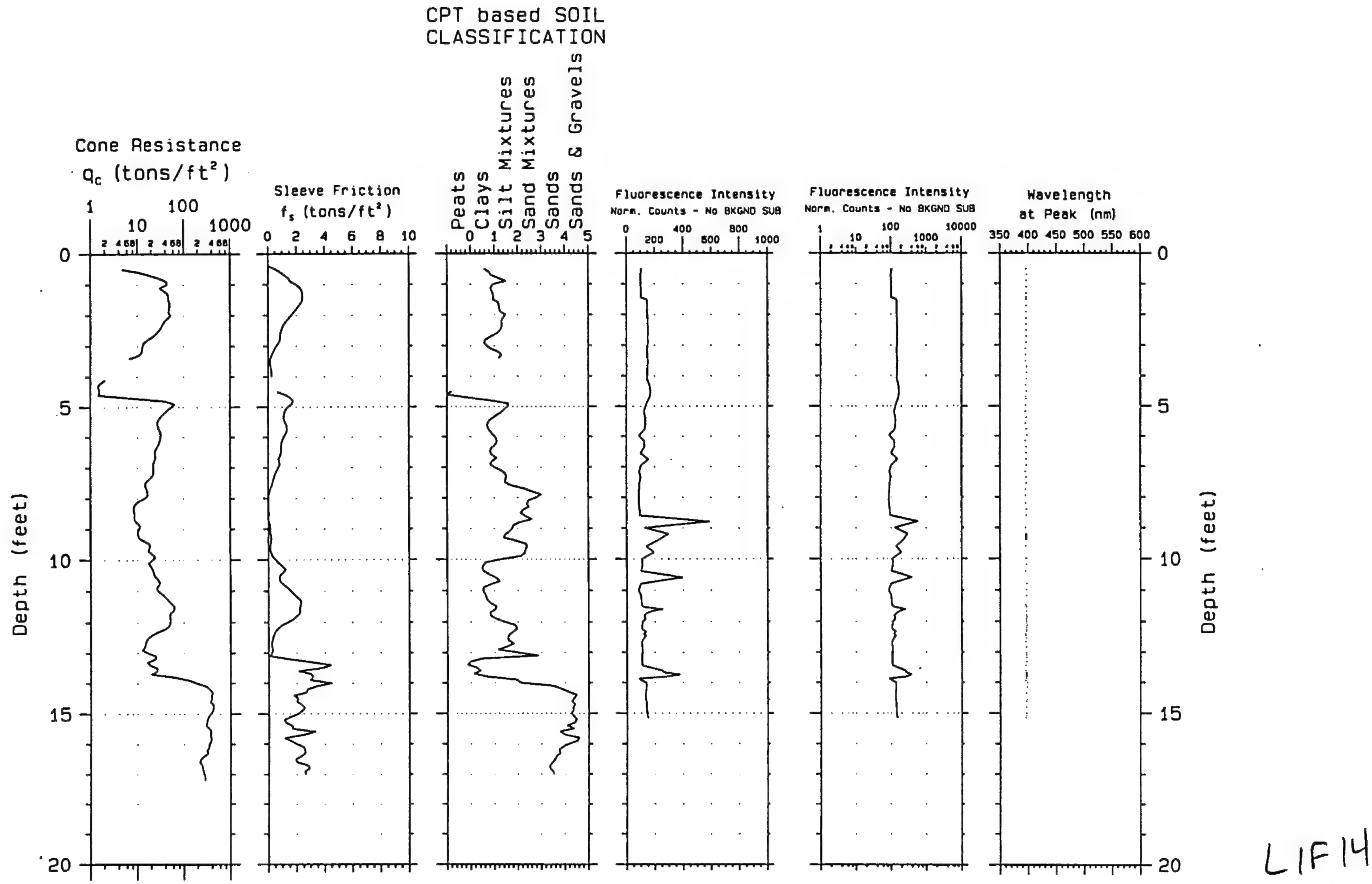
Probing date: 02-22-1995	Laser induced fluorescence of POL via fiber optics U.S.Army Engineer District Kansas City Geotechnical Branch	Project; Rickenbacker ANG Probe Depth; 23.19
	SCAPS	Site Characterization and Analysis Penetrometer System **CPT; 14RKRF1**



LIF 13

Probing date: 02-22-1995	Project; Rickenbacker ANG
Laser induced fluorescence of POL via fiber optics	Probe Depth; 20.80
U.S.Army Engineer District Kansas City Geotechnical Branch	SCAPS
Site Characterization and Analysis Penetrometer System	CPT; 15RKBF1

ESMP-2S 11.42



Laser induced fluorescence of POL via fiber optics

U.S.Army Engineer District Kansas City Geotechnical Branch

Probing date; 02-22-1995

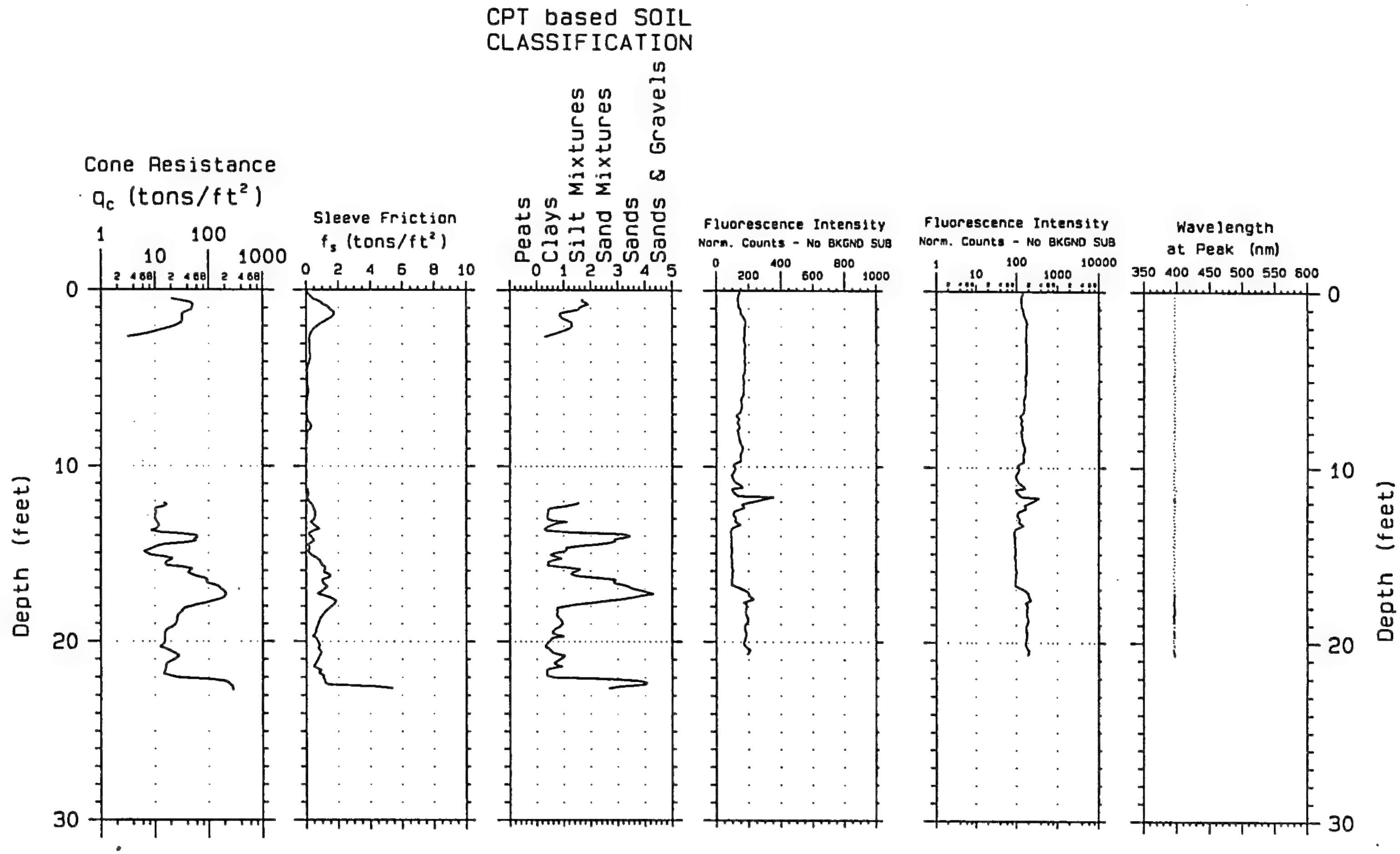
SCAPS

Site Characterization and Analysis Penetrometer System

Project; Rickenbacker ANG

Probe Depth; 17.32

CPT; 16RKRF1



LIF 15

Laser induced fluorescence of POL via fiber optics

U.S.Army Engineer District Kansas City Geotechnical Branch

Project; Rickenbacker ANG

Probe Depth; 22.86

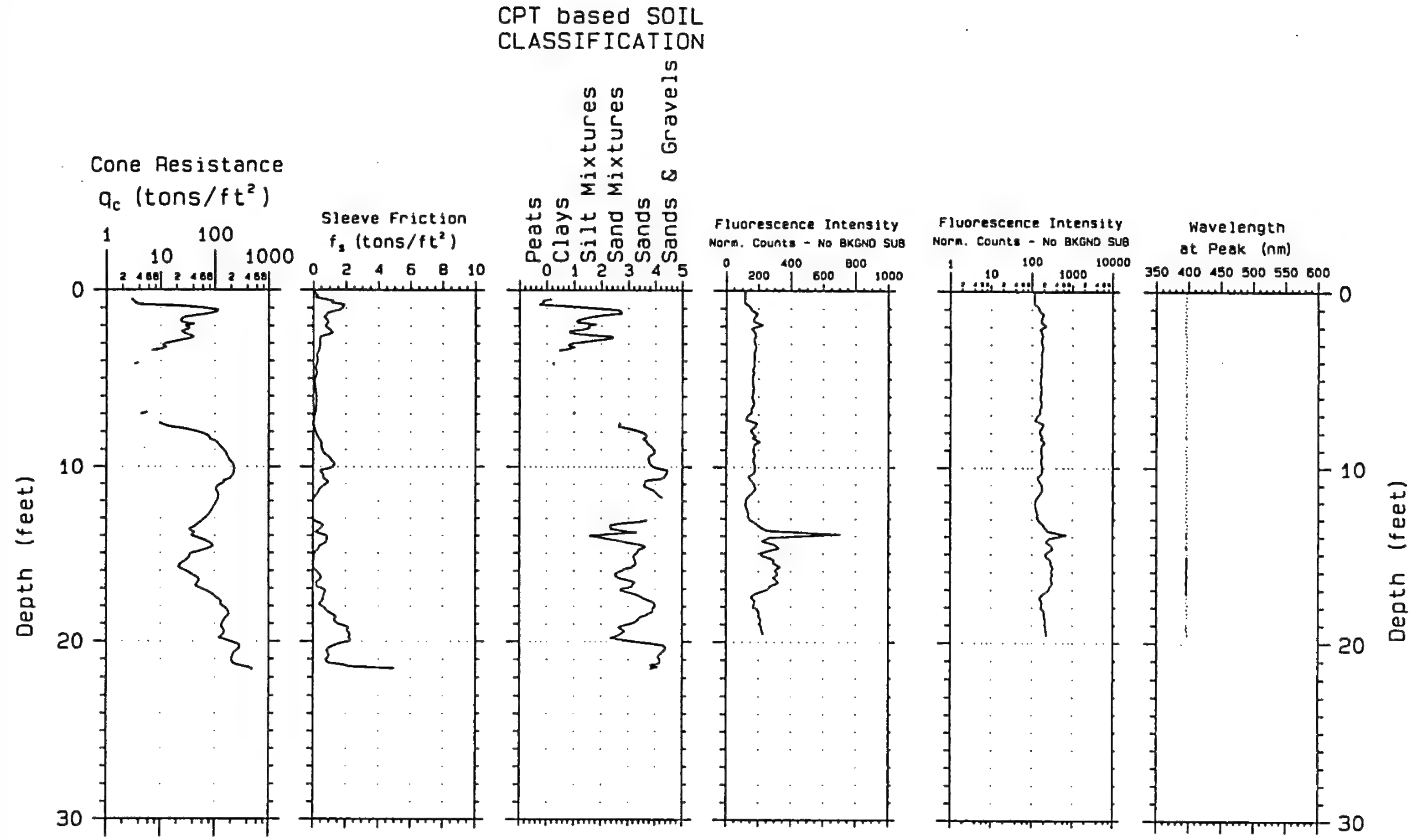
SCAPS

Site Characterization and Analysis Penetrometer System

CPT; 17RKRF1

Probing date; 02-22-1995

ESMP-145 @ 17.7



LIF 16

Laser induced fluorescence of POL via fiber optics

U.S. Army Engineer District Kansas City Geotechnical Branch

Probing date; 02-22-1995

SCAPS

Site Characterization and Analysis Penetrometer System

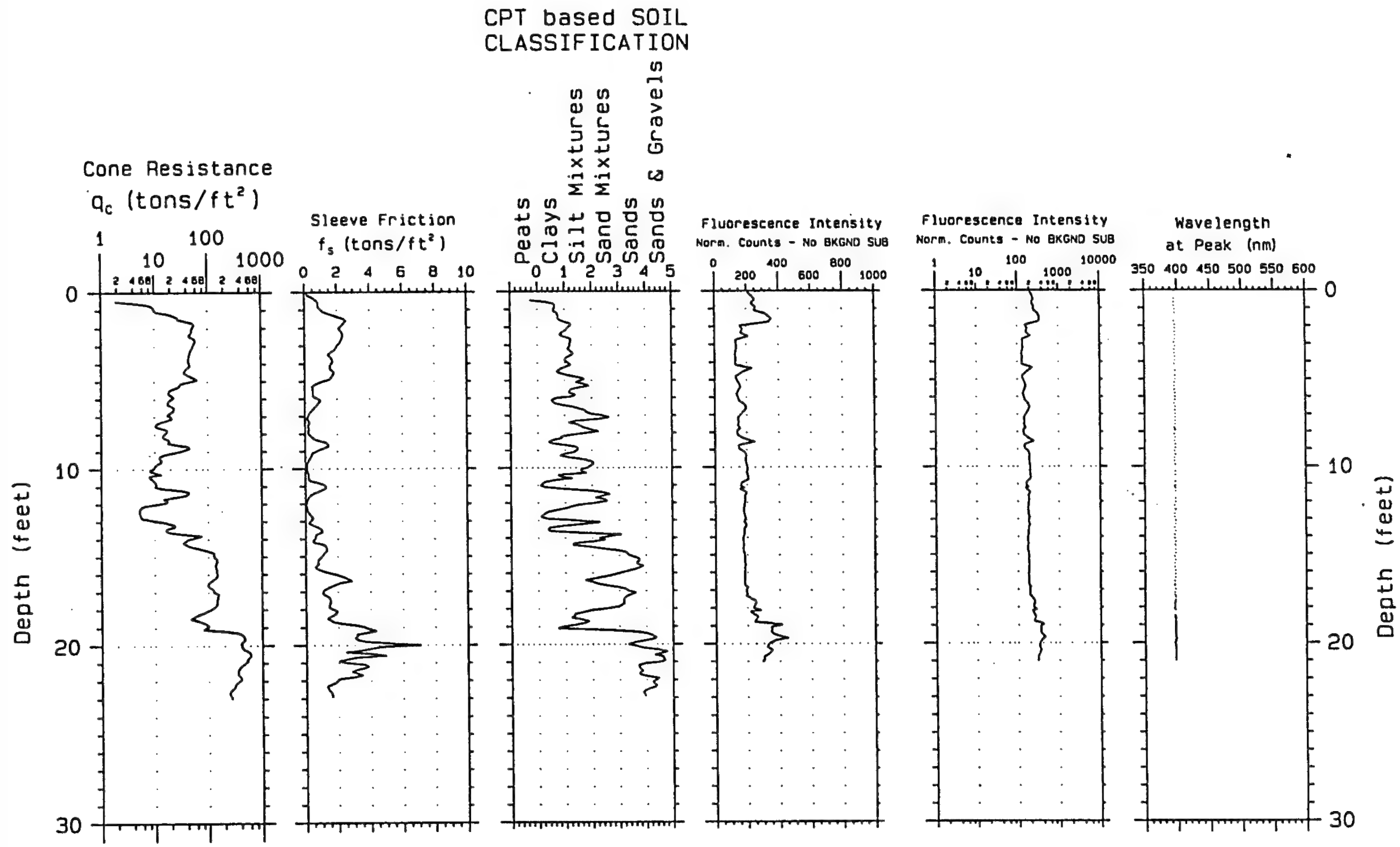
Project; Rickenbacker ANG

Probe Depth; 21.73

CPT; 18RKRF1

Near ESMP-16S 15.57

ESMP-16D 22.65



LIF-17

Laser induced fluorescence of POL via fiber optics

U.S.Army Engineer District Kansas City Geotechnical Branch

Probing date: 02-23-1995

SCAPS

Site Characterization and Analysis Penetrometer System

Project; Rickenbacker ANG

Probe Depth; 23.16

CPT; 35RKRF1

near ESMP-95 11.81

APPENDIX E

SUMMARY OF ANALYTICAL DATA, AUGUST 1995 - MARCH 1996

DRAFT

COMPARATIVE ANALYSIS OF NATURE AND EXTENT OF GROUNDWATER CONTAMINATION SITE 1 - HAZARDOUS WASTE STORAGE AREA (HWSA) RICKENBACKER AIR NATIONAL GUARD BASE, OHIO

PREPARED FOR

U.S. Air Force Center for Environmental Excellence
Brooks AFB, TX 78235

PREPARED BY

IT Corporation
11499 Chester Road
Cincinnati, Ohio 45246
(513) 782-4700

IT Project No. 762970
Contract F41624-94-D-8047

July, 1996

Introduction

This report presents a comparative analysis of laboratory and field data from four groundwater sampling events at the Hazardous Waste Storage Area (HWSA) at Rickenbacker Air National Guard Base (RANGB or the Base). The objective of the report is to determine if the nature and extent of the groundwater contamination has changed substantially since the initial round of sampling and analyses were performed by Parsons Engineering Science, Inc. (ES) in February 1995. Analytical data from the February 1995 groundwater sampling event were presented in the Amended Closure/Post Closure Plan in October 1995 and serve as baseline data. Additional groundwater analytical data collected by IT Corporation (IT) in August 1995, December 1995, and March 1996 are compared to the February 1995 data to assess changes in water quality.

Description of Site

The HWSA (Site 1) was a permitted storage facility that received wastes generated during Base activities from 1983 to 1986, when it was closed. Wastes were stored in drums placed on pallets inside Building 560 and outside within the fenced yard. Four underground storage tanks (USTs) formerly located southeast of Building 560 were removed in February 1995. The activities that generated the wastes stored in the HWSA included degreasing operations at Base shops, aircraft cleaning, and general maintenance activities (painting, paint stripping, etc.). The groundwater at Site 1 contains benzene, toluene, ethylbenzene, xylenes (BTEX) and chlorinated volatile organic compounds (VOCs). Figure 1 presents the location of the physical structures and the groundwater sampling locations at Site 1.

Geology and Hydrogeology of Site 1

The geology beneath the site consists of up to 200 feet of sandy and gravely Pleistocene age glacial outwash and silty and clayey glacial till filling a preglacial bedrock valley. The glacial geologic units beneath the Base are differentiated by stratigraphic and hydrogeologic characteristics. The first hydrogeologic unit beneath the base is the Upper Water Bearing Zone (UWBZ). The UWBZ, which extends from ground surface to approximately 25 feet below ground surface, consists of permeable (sands and gravels) and low permeable (silt and clay) layers. Groundwater in the UWBZ is under unconfined to semiconfined conditions. The UWBZ is underlain by a continuous, dense, grey, silty clay unit. Soil borings indicate that the clay layer is at least 5 feet thick across the Base.

ES completed groundwater monitoring wells and groundwater monitoring points at various depths in the UWBZ to evaluate the lateral and vertical extent of the groundwater contamination. Table 1 presents the completion data for the monitoring wells and monitoring points at Site 1. The monitoring wells were completed with ten foot long screens which in some cases, straddled a one foot thick clay layer within the UWBZ. In addition, monitoring points were installed using 3-foot long screens and are placed at discreet depths within the UWBZ to evaluate the vertical distribution of contaminants.

ES used monitoring wells and monitoring points to prepare the potentiometric maps included in the Amended Closure/Post Closure Plan. The potentiometric maps presented in the Amended Closure/Post Closure Plan illustrate areas of groundwater mounding and depressions near the site. Because the monitoring wells and monitoring points do not have corresponding screened intervals, IT prepared groundwater potentiometric surface maps using only groundwater elevations obtained from the monitoring wells. Figures 2, 3, and 4 are potentiometric surface maps for the August 15, 1995, December 20, 1995, and March 18, 1996 groundwater elevation sampling events. These maps indicate a north-south trending groundwater trough in the vicinity of the site. The interpreted groundwater flow direction is generally from north to south. Table 2 presents the groundwater elevation data used to prepare the potentiometric surface maps.

The groundwater advective flow velocity was calculated to evaluate the contaminant migration rate beneath Site 1. The data used for this calculation was taken from the information presented in the Amended Closure/Post Closure Plan, the Site Investigation Report (SI), and from the quarterly sampling conducted by IT. The formula used to calculate the advective flow velocity is:

$$V = \frac{K}{n_e} \frac{\Delta h}{\Delta L}$$

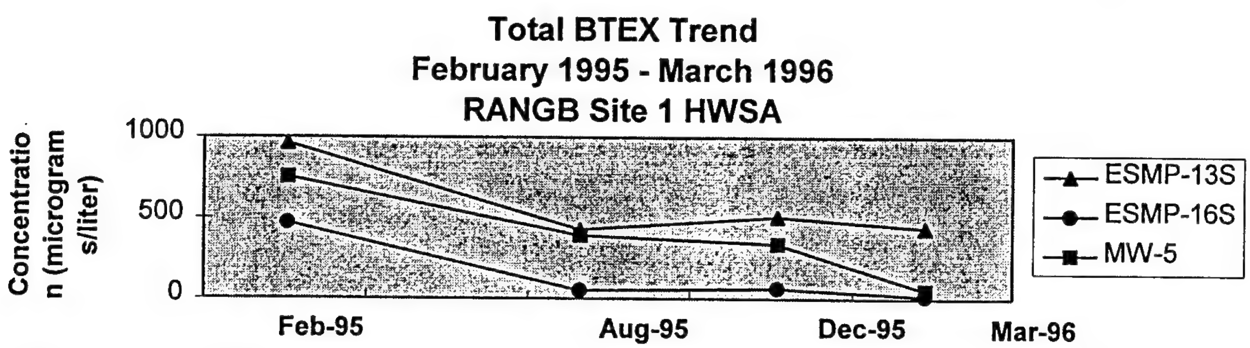
where: V = average linear velocity (ft/d)
K = hydraulic conductivity (ft/d)
n_e = effective porosity (dimensionless)
$\frac{\Delta h}{\Delta L}$ = hydraulic gradient (dimensionless)

Table 3 summarizes the groundwater flow velocity estimates for Site 1.

Nature and Extent of Contamination

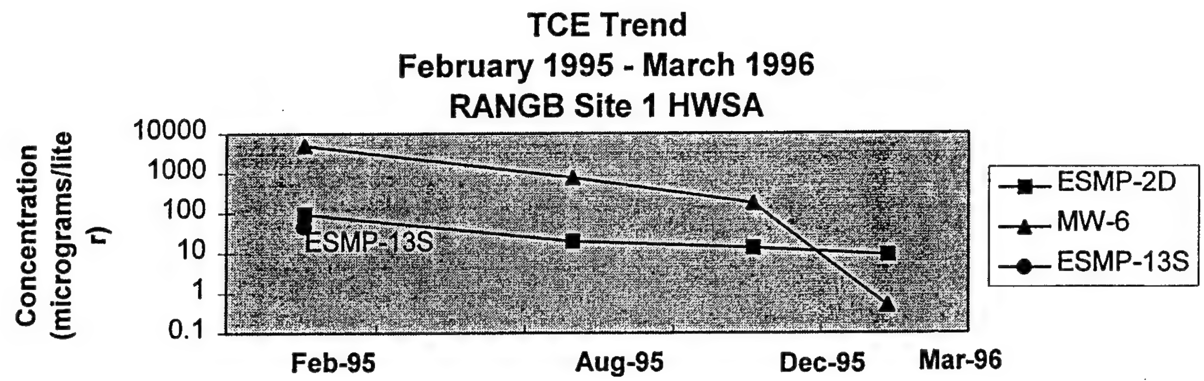
The principal contaminants in the groundwater beneath Site 1 are benzene, toluene, ethylbenzene, xylene (BTEX) compounds and chlorinated VOCs. The principal chlorinated VOCs are (cis- and trans-)1,2-dichloroethene, trichloroethene and vinyl chloride. The analytical results have been compared between sampling events to determine contaminant concentration and migration trends. Table 4 presents the sampling locations and parameters tested during the three quarterly sampling events. Tables 5, 6, 7 and 8 summarize the results of the four rounds of groundwater sampling conducted at Site 1. Figures 5, 6, and 7 present all of the compounds detected during the August 1995, December 1995, and March 1996 sampling events.

The vertical and horizontal extent of BTEX in groundwater has not changed significantly from the February, 1995 sampling event to the March, 1996 sampling event. However, total BTEX concentrations have decreased. The total BTEX concentration in MP-13S decreased from 963 μg/L in February, 1995 to 440 μg/L in March, 1996. The results of the sampling from MW-5 and MP-16S show similar results. The plume definition continues to be delineated by the lack of BTEX compounds detected in MP-17S, MW-8, MP-14D, MP-2D, MW-3, and MW-4. Figures 8, 9, and 10 present the BTEX plume location during the three quarterly sampling events. The following chart presents the trend in BTEX concentrations from February 1995 to March 1996.

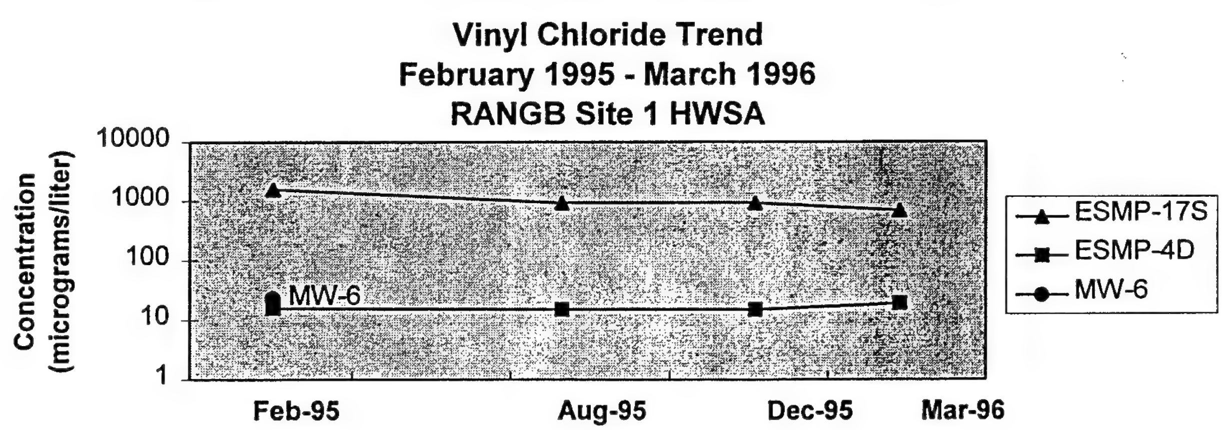


Trichloroethene (TCE) detections were observed in groundwater along the west side of the site during the February 1995 sampling event. The highest concentration was detected in the sample collected from MW-6 at >5,000 μg/L. Seven other locations contained TCE during the February 1995 sampling event at concentrations ranging from 1 μg/L to 95.6 μg/L. The concentrations of TCE decreased dramatically from February 1995 to August 1995. The TCE concentration in MW-6 decreased from >5,000 μg/L to 770 μg/L. Only one other sample contained detectable concentrations of TCE (MP-2D at 20 μg/L) during the August 1995 sampling. The reductions in TCE continued to the point where, during the March 1996 sampling event, the concentrations of

TCE were 11 μg/L in MW-6 and 9 μg/L in MP-2D. These locations also show decreasing or non-detectable concentrations of TCE decomposition products (e.g. vinyl chloride and 1,2-dichloroethene isomers). The following chart presents the decreasing trend in TCE concentration over time.

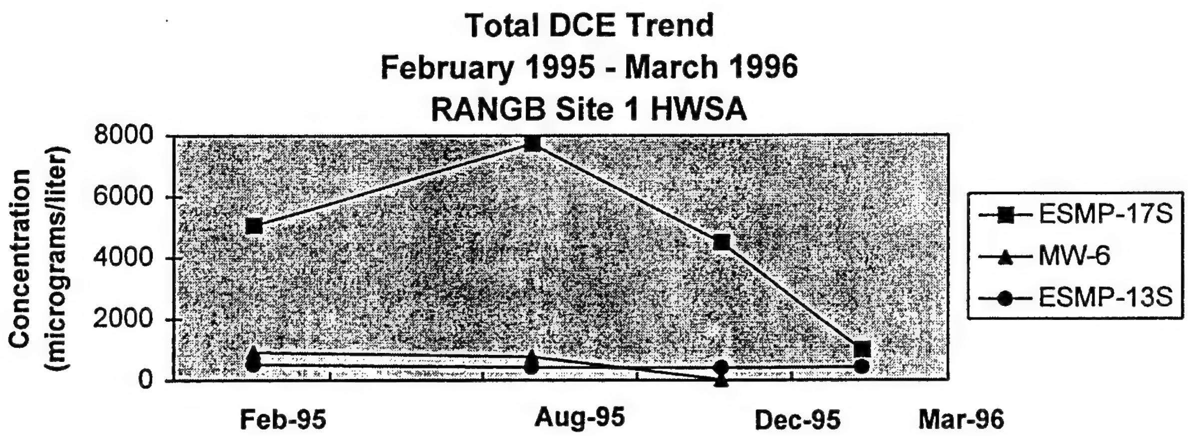


Vinyl Chloride was detected at 10 sampling locations during the February 1995 sampling event at locations spread across the site. The highest concentrations were in MW-17S along the east side of the site and in MW-6. The concentration of vinyl chloride in MW-6 decreased from 23.1 μg/L in February 1995 to below detection limit in March 1996. A reduction in vinyl chloride concentration is also apparent in the samples collected from MP-17S. However, the reduction is not as substantial. The concentrations of vinyl chloride in MP-17S from the four sampling events were 1,570 μg/L (February 1995), 930 μg/L (August 1995), 1,200 μg/L (December 1995), and 690 μg/L (March 1996). The following chart graphically presents this trend.



The other contaminants which have shown elevated concentrations are the cis- and trans- isomers of 1,2-dichloroethene (1,2-DCE). The cis- and trans- isomers of 1,2-DCE have been summed in the tables and maps. The total 1,2-DCE concentrations were distributed across the site at

essentially the same locations as the vinyl chloride. The maximum concentrations detected in the February 1995 sampling event were present at MP-17S (5,065 μg/L), MW-6 (920 μg/L), and MP-13S (528 μg/L). Two other locations sampled during February 1995 contained detectable concentrations of total 1,2-DCE; however, in each case the concentration was minimal (i.e. <5 μg/L). The trend in 1,2-DCE concentrations is generally toward lower concentrations. The 1,2-DCE that was present along the western portion of the site during the February 1995 sampling have generally decreased to less than detectable concentrations. The concentrations detected during the March 1996 sampling event in the eastern sampling locations (i.e. MP-13S, MP-17S and MP-14D) have decreased when compared to the concentrations detected during February 1995. The 1,2-DCE concentration trend is presented in the following graph.



Groundwater Remediation

Intrinsic remediation was selected as the remedial alternative for groundwater at the site. IT has collected data to evaluate the results of the selected groundwater remediation technology. Intrinsic remediation recognizes natural attenuation to reduce the BTEX contaminant concentrations. Natural attenuation refers to a combination of sorption, dispersion, and biodegradation that results in a reduction of contaminant concentrations. Chlorinated VOCs are degraded during intrinsic remediation through a process known as cometabolism. Chlorinated VOC degradation is accomplished from enzymes produced during the degradation of the BTEX compounds. Cometabolism rates generally increase as reducing conditions increase.

Several field and laboratory parameters are measured on a quarterly basis in conjunction with laboratory analyses of the contaminants of concern, to determine the effectiveness of the selected remediation technology. These parameters include dissolved oxygen, pH, temperature, conductivity, redox potential, total alkalinity, sulfides, ferrous iron, chloride, sulfates, nitrates

and nitrites, methane, ethene, ethane, and ammonia. Many of these parameters are used as "yardsticks" to determine if biological activities (as determined through the presence of aerobic and anaerobic respiration) are reducing contaminant concentrations. Tables 9, 10, 11 and 12 summarize the results of the natural attenuation parameter sampling.

Intrinsic Remediation Indicator Parameters

Dissolved oxygen (DO) is tested at each location where a groundwater sample is collected to determine if aerobic bioremediation is active in the groundwater. A DO concentration greater than 1 mg/L is considered necessary to support aerobic processes. Clear trends in DO are not apparent from the field readings. The data collected in February 1995 show only two locations with DO greater than 1 mg/L indicating that aerobic activity is probably not an important process. The data collected in August 1995 shows a similar situation in that the samples collected near the BTEX plume each show relatively low concentrations of DO. The DO meter used during the December 1995 sampling ceased working after only a few of the samples were analyzed. The samples that were analyzed were outside the BTEX plume; therefore, information on the DO character within the plume are not available for this sampling event. The results of the March 1996 sampling shows unusually high DO readings in each of the samples indicating a malfunctioning meter. An attempt was made to relate each of the readings back to the minimum reading from all locations to determine if a trend exists. The relative readings do not show correlation where aerobic and anaerobic processes would be likely to occur. Figures 11, 12, and 13 present the results of the DO readings from each of the quarterly sampling events.

Nitrate and nitrite concentrations (as nitrogen) were measured in groundwater samples collected during each round of groundwater sampling. The results of this sampling does not indicate a significant trend in nitrogen concentrations within the BTEX plume. Additional sampling of these parameters will be necessary to draw conclusions based on nitrogen concentrations. Figure 14 presents the results of the nitrogen sampling conducted in August 1995.

Ferrous iron concentrations were measured in groundwater samples collected during each groundwater sampling event. The results of this sampling are presented on Figure 15. The highest concentrations of ferrous iron are generally associated with samples collected from monitoring points MP-16S, MP-16D and MP-17S which are located near the center of the groundwater contamination. These elevated levels of ferrous iron suggest that ferric iron

hydroxide is being reduced to ferrous iron during anaerobic biodegradation of BTEX compounds.

Groundwater samples for sulfate analysis were collected during each sampling event. Figure 16 presents the results of the sulfate sampling conducted during the quarterly sampling events. The results of these sampling events show reduced concentrations of sulfates in the area of BTEX contamination. This situation suggests anaerobic biodegradation of BTEX compounds in the shallow groundwater through the microbially mediated process of sulfate reduction.

Methane, ethane and ethene analyses were conducted on groundwater samples collected during each round of groundwater sampling to determine if methanogensis is occurring at this site. Each of the sampling events show that the elevated levels of methane are generally associated with the location of the BTEX plume. These relations suggest that anaerobic biodegradation of BTEX compounds via methanogensis is occurring at this site. Figures 17, 18, and 19 present the results of the methane sampling.

Conclusions

The results of the three quarterly groundwater sampling events were compared to the sampling event conducted in February 1995 and used in the Amended Closure Plan submitted in October 1995. This comparison shows the extent of the BTEX plume has not changed substantially. However, the nature of the plume has changed in that the concentrations have decreased. Contamination from chlorinated VOCs including vinyl chloride, total 1,2-DCE and TCE continue to exist in the groundwater beneath the site. However, the extent and the concentration of the contaminants have decreased since February 1995.

The "yardstick" parameters for determining the effectiveness of intrinsic remediation show biological activity is likely to be remediating the BTEX plume beneath Site 1. Without verifiable dissolved oxygen data, it is difficult to determine if aerobic activity is occurring. But, the other natural attenuation parameter results suggest that anaerobic activity is present.

The fourth quarter groundwater sampling was conducted in June 1996. The nature and extent of contamination at the site will be reevaluated when this data and future quarterly sampling event data are available. However, the currently available data indicate no significant migration of

contaminants is occurring and contaminant concentrations are decreasing. Therefore, the selected remedial action of natural attenuation appears sufficient to reduce the risk to human health and the environment posed by the groundwater.

Table 1

Monitoring Point and Existing Well Completion Details
Hazardous Waste Storage Area
Rickenbacker ANGB, Ohio

Location	Installation Date	Easting	Northing	Datum Elevation (ft msl) [a]	Ground Elevation (ft msl)	PVC Casing ID (inches)	Screen Length (feet)	Total Depth (ft btoc) [b]	Depth to Top of Screen (ft btoc)	Depth to Base of Screen (ft btoc)
ESMP-1S	02/23/95	1845016	662614	741.67	741.60	0.50	3.28	11.70	8.42	11.70
ESMP-1D	02/23/95	1845015	662615	741.72	741.60	0.50	3.28	18.80	15.52	18.80
ESMP-2S	02/23/95	1845023	662568	741.18	741.20	0.50	3.28	11.42	8.14	11.42
ESMP-2D	02/23/95	1845025	662569	741/29	741.20	0.50	3.28	22.50	19.22	22.50
ESMP-3S	02/23/95	1844958	662524	742.23	741.80	0.50	3.28	12.55	9.27	12.55
ESMP-3D	02/23/95	1844959	662526	742.22	741.80	0.50	3.28	22.19	18.91	22.19
ESMP-4S	02/23/95	1844996	662467	742.70	742.60	0.50	3.28	12.58	9.30	12.58
ESMP-4D	02/23/95	1844997	662467	742.69	742.60	0.50	3.28	18.44	15.16	18.44
ESMP-5S	02/23/95	1844891	662345	741.51	741.50	0.50	3.28	12.51	9.23	12.51
ESMP-5D	02/23/95	1844893	662346	741.56	741.50	0.50	3.28	22.54	19.26	22.54
ESMP-6S	02/23/95	1845105	662411	740.98	741.00	0.50	3.28	15.80	12.52	15.80
ESMP-6D	02/23/95	1845105	662412	741.05	741.00	0.50	3.28	23.51	20.23	23.51
ESMP-7S	02/23/95	1845181	662330	740.85	740.80	0.50	3.28	11.75	8.47	11.75
ESMP-7D	02/23/95	1845179	662331	740.80	740.80	0.50	3.28	23.59	20.31	23.59
ESMP-8S	02/23/95	1845049	662261	740.92	740.80	0.50	3.28	10.72	7.44	10.72
ESMP-8D	02/23/95	1845050	662261	740.89	740.90	0.50	3.28	22.81	19.53	22.81
ESMP-8DD	02/23/95	1845052	662259	740.83	740.80	0.50	3.28	29.74	26.46	29.74

Table 1

Monitoring Point and Existing Well Completion Details
Hazardous Waste Storage Area
Rickenbacker ANGB, Ohio

Location	Installation Date	Easting	Northing	Datum Elevation (ft msl) [a]	Ground Elevation (ft msl)	PVC Casing ID (inches)	Screen Length (feet)	Total Depth (ft btoc) [b]	Depth to Top of Screen (ft btoc)	Depth to Base of Screen (ft btoc)
ESMP-9S	02/23/95	1845034	662143	741.79	741.60	0.50	3.28	11.81	8.53	11.81
ESMP-9D	02/23/95	1845036	662143	741.70	741.60	0.50	3.28	21.85	18.57	21.85
ESMP-10S	02/23/95	1844945	662265	741.56	741.50	0.50	3.28	15.84	12.56	15.84
ESMP-10D	02/23/95	1844942	662265	741.54	741.50	0.50	3.28	22.07	18.79	22.07
ESMP-11S	02/23/95	1845124	662341	740.76	740.80	0.50	3.28	15.78	12.50	15.78
ESMP-11D	02/23/95	1845123	662343	740.80	740.80	0.50	3.28	22.82	19.54	22.82
ESMP-12S	02/24/95	1844991	662762	741.43	741.30	0.50	3.28	15.73	12.45	15.73
ESMP-13S	02/24/95	1845072	662515	741.38	741.40	0.50	3.28	16.18	12.90	16.18
ESMP-13D	02/24/95	1845071	662515	741.38	741.40	0.50	3.28	21.48	18.20	21.48
ESMP-14S	02/24/95	1845102	662475	741.17	741.40	0.50	3.28	17.70	14.42	17.70
ESMP-14D	02/24/95	1845103	662474	741.18	741.00	0.50	3.28	24.58	21.30	24.58
ESMP-14DD	02/24/95	1845103	662476	741.13	741.00	0.50	3.28	29.71	26.43	29.71
ESMP-15S	02/24/95	1845143	662479	740.37	740.20	0.50	3.28	17.52	14.24	17.52
ESMP-15D	02/24/95	1845145	662478	740.28	740.20	0.50	3.28	24.90	21.62	24.90
ESMP-16S	02/24/95	1845132	662598	740.33	740.30	0.50	3.28	15.57	12.29	15.57
ESMP-16D	02/24/95	1845130	662601	740.33	740.30	0.50	3.28	22.65	19.37	22.65
ESMP-17S	02/24/95	1845192	662495	739.87	739.90	0.50	3.28	15.62	12.34	15.62

Table 1

Monitoring Point and Existing Well Completion Details
Hazardous Waste Storage Area
Rickenbacker ANGB, Ohio

Location	Installation Date	Easting	Northing	Datum Elevation (ft msl) [a]	Ground Elevation (ft msl)	PVC Casing ID (inches)	Screen Length (feet)	Total Depth (ft btoc) [b]	Depth to Top of Screen (ft btoc)	Depth to Base of Screen (ft btoc)
MW-2	07/29/88	1845118	662544	743.36	741.10	2	10	16.91	6.91	16.91
MW-3	08/10/88	1844999	662599	743.96	741.60	2	10	20.10	10.10	20.10
MW-4	01/29/90	1844979	662691	745.15	741.80	2	10	18.30	8.30	18.30
MW-5	01/31/90	1845051	662617	744.97	741.60	2	10	18.04	8.04	18.04
MW-6	01/30/90	1844991	662524	745.18	741.70	2	10	17.99	7.99	17.99
MW-8	01/30/90	1845159	662431	743.89	740.40	2	10	18.44	8.44	18.44
MW-9	02/09/90	1845083	662643	745.25	741.60	2	10	18.27	8.27	18.27
MW-10	10/14/91	1845165	662544	742.64	740.30	2	10	20.16	10.16	20.16
MW-11	10/15/91	1845017	662429	744.15	741.40	2	10	19.77	9.77	19.77
MW-12	10/15/91	1845120	662394	743.02	740.80	2	10	20.06	10.06	20.06

[a] ft msl = feet above mean sea level.
[b] ft btoc = feet below top of casing.

Table 2
Groundwater Elevation Data
Hazardous Waste Storage Area
Rickenbacker ANGB, Ohio

Well ID	Datum Elevation (ft msl)	08/15/95 Depth to Water (ft)	08/15/95 Elevation of Groundwater (ft msl)	12/20/95 Depth to Water (ft)	12/20/95 Elevation of Groundwater (ft msl)	03/18/96 Depth to Water (ft)	03/18/96 Elevation of Groundwater (ft msl)
MW-02	743.36	12.14	731.22	13.23	730.13	11.26	732.1
MW-03	743.96	10.46	733.5	13.05	730.91	8.6	735.36
MW-04	745.15	11.38	733.77	13.26	731.89	9.86	735.36
MW-05	744.97	13.37	731.6	NA (free product)	NA	NA	NA
MW-06	745.18	13.75	731.43	14.96	730.22	13.06	732.12
MW-08	743.89	10.53	733.36	12.94	730.95	8.43	735.46
MW-09	745.25	8.05	737.2	13.55	731.7	NA	NA
MW-10	742.64	11.23	731.41	12.3	730.34	NA	NA
MW-11	744.15	12.19	731.96	13.55	730.6	11.64	732.51
MW-12	743.02	13.1	729.92	13.71	729.31	11.98	731.04
ESMP-1S	741.67	7.43	734.24	9.44	732.23	5.65	736.02
ESMP-1D	741.72	10.17	731.55	10.56	731.16	8.87	732.85
ESMP-2S	741.18	3.57	737.61	5.83	735.35	1.73	739.45
ESMP-2D	741.29	6.18	735.11	10.1	731.19	8.55	732.74
ESMP-3S	742.23	7.68	734.55	11.26	730.97	7.82	734.41
ESMP-3D	742.22	10.69	731.53	11.92	730.3	9.94	732.28
ESMP-4S	742.7	5.94	736.76	9.92	732.78	6.92	735.78
ESMP-4D	742.69	11.15	731.54	12.23	730.46	10.42	732.27
ESMP-5S	741.51	3.83	737.68	6.89	734.62	3.46	738.05
ESMP-5D	741.56	6.2	735.36	9	732.56	2.07	739.49
ESMP-6S	740.98	10.79	730.19	NA	NA	NA	NA
ESMP-6D	741.05	9.69	731.36	10.69	730.36	8.87	732.18
ESMP-7S	740.85	6.02	734.83	5.33	735.52	3.69	737.16
ESMP-7D	740.8	5.96	734.84	8.62	732.18	5.57	735.23
ESMP-8S	740.92	3.76	737.16	6.73	734.19	2.87	738.05
ESMP-8D	740.89	6.17	734.72	8.85	732.04	NA	NA
ESMP-8DD	740.83	7.38	733.45	9.58	731.25	7.07	733.76
ESMP-9S	741.79	3.38	738.41	5.22	736.57	1.46	740.33
ESMP-9D	741.7	6.53	735.17	9.35	732.35	6.27	735.43
ESMP-10S	741.56	6.15	735.41	10.03	731.53	7.26	734.43
ESMP-10D	741.54	6.41	735.13	9.22	732.32	6.28	735.26
ESMP-11S	740.76	6.66	734.1	7.15	733.61	6.42	734.34
ESMP-11D	740.8	7.11	733.69	9.04	731.76	6.69	734.11
ESMP-12S	742.43	2.57	739.86	6.23	736.2	0.4	742.03
ESMP-13S	741.38	10.34	731.04	10.9	730.48	9.34	732.04
ESMP-13D	741.38	10.06	731.32	10.56	730.82	9.1	732.28
ESMP-14S	741.17	10.13	731.04	10.31	730.86	9.16	732.01
ESMP-14D	741.18	9.89	731.29	10.37	730.81	8.92	732.26
ESMP-14DD	741.13	9.72	731.41	10.56	730.57	8.93	732.2
ESMP-15S	740.37	9.45	730.92	9.68	730.69	8.47	731.9
ESMP-15D	740.28	8.98	731.3	9.45	730.83	7.98	732.3
ESMP-16S	740.33	8	732.33	9.6	730.73	7.78	732.55
ESMP-16D	740.33	8.77	731.56	9.18	731.15	7.87	732.46
ESMP-17S	739.87	9.19	730.68	9.56	730.31	8.52	731.35

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Table 3

Summary of Groundwater Velocity Calculations
Hazardous Waste Storage Area
Rickenbacker ANGB, Ohio

Date of GW Elevation Measurement	Monitoring Wells	K[1] (ft/d)	Δh^2 (ft)	ΔL^3 (ft)	$n_e{}^4$	V (ft/day)	V (ft/yr)
8/15/95	MW-9, MW-12	0.62	7.28	495	0.3	3.04E-02	1.10E+01
12/20/95	MW-9, MW-12	0.62	2.39	495	0.3	9.98E-03	3.60E+00
3/18/96	MW-4, MW-6	1.375	3.17	162	0.3	8.97E-02	3.30E+01
7/1/96	HC-MW1, HC-MW2	2.50E-07	24.34	80	0.3	2.54E-07	9.3 E-5

1 Source of K is slug tests for MW-4, MW-6, MW-9, and MW-12. (Amended Closures/Post Closure Plan) For the clay layer between HC-MW-1 and HC-MW-2 the K value was taken form the source presented in the OEPA letter dated April 10, 1996 (Lindeburg, Michael, R., Civil Engineering Reference Manual, 4th Ed.)

2 dh for MW-4, MW-6, MW-9, and MW-12 are presented in Table 2. dh for HC wells is from recent sampling.

3 dL for MW-4, MW-6, MW-12 is taken from Figure 1. Dl for HC wells is the depth between the middle of each screened interval.

4 Amended Closure/Post Closure Plan

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Table 4

Analytical Parameters
Hazardous Waste Storage Area
Rickenbacker ANGB, Ohio

Well	VOC	SVOC	Metals (unfiltered)	Metals (filtered)	Natural Attenuation Parameters[a]	Field Parameters[b]
MW-3	X				X	X
MW-4	X	X	X	X	X	X
MW-5	X				X	X
MW-6	X				X	X
MW-8	X	X	X	X	X	X
MW-11	X	X	X	X	X	X
MW-12	X	X	X	X	X	X
ESMP-2D	X				X	X
ESMP-3D	X				X	X
ESMP-4S	X				X	X
ESMP-4D	X				X	X
ESMP-6D	X				X	X
ESMP-8S	X				X	X
ESMP-10S	X				X	X
ESMP-13S	X				X	X
ESMP-14D	X				X	X
ESMP-16S	X				X	X
ESMP-16D	X				X	X
ESMP-17S	X				X	X

(a) Natural attenuation parameters included methane, ethene, ammonia, nitrogen, nitrite, nitrate, sulfate, alkalinity, and chloride.

(b) Field Parameters included pH, temperature, conductivity and the following natural attenuation parameters: ferrous iron, sulfide, alkalinity, dissolved oxygen, and oxidation reduction potential.

Table 5

Organic Chemicals Detected in Groundwater
February, 1995
Hazardous Waste Storage Area
Rickenbacker ANGB, Ohio

Sample Location	Sample Date	Benzene (µg/L)	Toluene (µg/L)	Ethylbenzene (µg/L)	Total Xylenes (µg/L)	Total BTEX (µg/L)	Vinyl Chloride (µg/L)	1,1-DCE (µg/L)	Total 1,2-DCE (µg/L)	TCE (µg/L)
ESMP-1S	02/28/95	ND[(a)]	BLQ[(b)]	ND	ND	BLQ	ND	ND	ND	ND
ESMP-1D	02/28/95	ND	BLQ	BLQ	ND	BLQ	ND	ND	ND	ND
ESMP-2S	02/28/95	NA[(c)]	NA	NA	NA	NA	ND	ND	ND	ND
ESMP-2D	02/28/95	ND	1.05	ND	ND	1.05	ND	ND	1.00	95.60
ESMP-3S	02/28/95	NA	NA	NA	NA	NA	ND	ND	ND	1.00
ESMP-3D	02/28/95	ND	BLQ	ND	ND	BLQ	ND	ND	1.30	6.50
ESMP-4S	02/28/95	ND	BLQ	ND	ND	BLQ	1.00	ND	ND	ND
ESMP-4D	02/28/95	ND	2.48	ND	ND	2.48	16.00	ND	ND	ND
ESMP-5S	02/27/95	ND	BLQ	BLQ	BLQ	BLQ	ND	ND	ND	ND
ESMP-5D	02/27/95	ND	ND	ND	ND	ND	ND	ND	ND	ND
ESMP-6S	02/28/95	ND	3.13	ND	ND	3.13	NA	NA	NA	NA
ESMP-6D	02/28/95	ND	BLQ	ND	ND	BLQ	1.70	ND	ND	ND
ESMP-6D(D)	02/28/95	NA	NA	NA	NA	NA	2.00	ND	ND	ND
ESMP-7S	02/28/95	BLQ	BLQ	ND	ND	BLQ	ND	ND	ND	ND
ESMP-7D	02/28/95	BLQ	BLQ	BLQ	BLQ	0.00	ND	ND	ND	ND
ESMP-8S	02/27/95	ND	1.30	ND	ND	BLQ	ND	ND	ND	BCL
ESMP-8DD	02/27/95	ND	BLQ	ND	BLQ	BLQ	ND	ND	ND	BCL
ESMP-9S	02/28/95	ND	BLQ	BLQ	ND	BLQ	ND	ND	ND	BCL
ESMP-9D	02/28/95	ND	BLQ	ND	BLQ	ND	ND	ND	ND	ND
ESMP-10S	02/27/95	ND	BLQ	ND	BLQ	BLQ	ND	ND	ND	1.00
ESMP-10S(D)	02/27/95	NA	NA	NA	NA	NA	ND	ND	ND	1.00
ESMP-10D	02/27/95	ND	BLQ	ND	ND	BLQ	ND	ND	ND	ND
ESMP-11D	02/27/95	BLQ	BLQ	BLQ	BLQ	BLQ	ND	ND	ND	ND
ESMP-12S	03/01/95	ND	2.44	BLQ	ND	2.44	ND	ND	ND	BCL
ESMP-13S	02/28/95	424.18	22.41	237.09	279.58	963.26	2.70	1.30	528.00	45.60
ESMP-13D	02/28/95	ND	ND	BLQ	ND	BLQ	ND	ND	ND	ND
ESMP-13D(D)	02/28/95	NA	NA	NA	NA	NA	ND	ND	ND	ND
ESMP-14S	02/28/95	ND	ND	ND	ND	ND	ND	ND	ND	ND

Table 5

Organic Chemicals Detected in Groundwater
February, 1995
Hazardous Waste Storage Area
Rickenbacker ANGB, Ohio
Page 2 of 2

Sample Location	Sample Date	Benzene (µg/L)	Toluene (µg/L)	Ethylbenzene (µg/L)	Total Xylenes (µg/L)	Total BTEX (µg/L)	Vinyl Chloride (µg/L)	1,1-DCE (µg/L)	Total 1,2-DCE (µg/L)	TCE (µg/L)
ESMP-14(D)	02/28/95	NA	NA	NA	NA	NA	ND	ND	ND	ND
ESMP-14D	02/28/95	ND	BLQ	ND	ND	BLQ	1.00	ND	2.20	ND
ESMP-14D(D)	02/28/95	NA	NA	NA	NA	NA	1.00	ND	2.10	ND
ESMP-14DD	02/28/95	ND	BLQ	ND	ND	BLQ	ND	ND	ND	BLC
ESMP-15S	02/28/95	BLQ	1.08	BLQ	BLQ	1.08	ND	ND	ND	ND
ESMP-15D	02/28/95	ND	BLQ	ND	BLQ	BLQ	ND	ND	ND	ND
ESMP-16S	03/01/95	89.18	BLQ	228.5	153.65	471.33	ND	ND	ND	ND
ESMP-16D	03/01/95	6.46	BLQ	26.87	62.03	95.36	ND	ND	ND	ND
ESMP-17S	02/28/95	BLQ	ND	ND	ND	BLQ	1570.00	11.70	5065.00	BCL
MW-2	03/01/95	BLQ	BLQ	BLQ	BLQ	BLQ	ND	ND	ND	ND
MW-3	02/28/95	BLQ	BLQ	BLQ	BLQ	BLQ	ND	ND	ND	1
MW-4	03/01/95	BLQ	BLQ	BLQ	BLQ	BLQ	ND	ND	ND	ND
MW-5	03/01/95	17.19	41.94	317.97	375.93	753.03	ND	ND	ND	ND
MW-6	02/28/95	1.67	BLQ	BLQ	BLQ	1.67	23.1	6.5	920.00	ACL[e]
MW-6(D)	02/28/95	NA	NA	NA	NA	NA	21.9	6.5	837.00	9580
MW-8	02/28/95	BLQ	ND	ND	ND	BLQ	ND	ND	ND	BCL
MW-9	03/01/95	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-10	03/01/95	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-11	02/28/95	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-11(D)	02/28/95	NA	NA	NA	NA	NA	ND	ND	ND	BCL
MW-12	02/28/95	ND	BLQ	ND	ND	BLQ	ND	ND	ND	ND
MW-12(D)	02/28/95	NA	NA	NA	NA	NA	ND	ND	ND	BCL

(a) ND = not detected.
(b) BLQ = below limit of quantitation.
(c) NA = not analyzed.
(d) BCL = below calibration limit (1.0 µg/L).
(e) ACL = above calibration limit (5000 µg/L).

Table 6

Organic Chemicals Detected in Groundwater
August, 1995
Hazardous Waste Storage Area
Rickenbacker ANGB,Ohio

Sample Location	Sample Date	Benzene (µg/L)	Toluene (µg/L)	Ethylbenzene (µg/L)	Total Xylenes (µg/L)	Total BTEX (µg/L)	Vinyl Chloride (µg/L)	1,2-DCE (Total) (µg/L)	TCE (µg/L)	Methylene Chloride (µg/L)	Chloroform (µg/L)
ESMP-2D	Aug-95	ND	ND	ND	ND	ND	ND	ND	20	ND	ND
ESMP-3D	Aug-95	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ESMP-4S	Aug-95	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ESMP-4D	Aug-95	ND	ND	ND	ND	ND	15	ND	ND	ND	ND
ESMP-6D	Aug-95	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ESMP-8S	Aug-95	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ESMP-10S	Aug-95	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ESMP-13S	Aug-95	200	ND	130	100	430	ND	430	ND	ND	ND
ESMP-14D	Aug-95	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ESMP-16S	Aug-95	23	ND	23	7	53	ND	12	ND	ND	ND
ESMP-16D	Aug-95	7	ND	69	70	146	ND	ND	ND	ND	ND
ESMP-17S	Aug-95	ND	ND	ND	ND	ND	930 E	7730 E	ND	ND	2 J
ESMP-17S (DUPE)	Aug-95	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-3	Aug-95	ND	ND	ND	ND	ND	ND	ND	ND	2 J	ND
MW-4	Aug-95	ND	ND	ND	ND	ND	ND	ND	ND	3 J	ND
MW-5	Aug-95	ND	15	170	210	395	ND	ND	ND	ND	ND
MW-6	Aug-95	ND	ND	ND	ND	ND	ND	ND	770	ND	ND
MW-8	Aug-95	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-11	Aug-95	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-12	Aug-95	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-12 (DUPE)	Aug-95	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-13	Aug-95	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

(a) ND = not detected.
(b) BLQ = below limit of quantitation.
(c) NA = not analyzed.
(d) BCL = below calibration limit (1.0 µg/L).
(e) ACL = above calibration limit (5000 µg/L).

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Organic Chemicals Detected in Groundwater
December, 1995
Hazardous Waste Storage Area
Rickenbacker ANGB, Ohio

Sample Location	Sample Date	Benzene (µg/L)	Toluene (µg/L)	Ethylbenzene (µg/L)	Total Xylenes (µg/L)	Total BTEX (µg/L)	Vinyl Chloride (µg/L)	1,2-DCE(Total) (µg/L)	TCE (µg/L)	2-Butanone (µg/L)	Acetone (µg/L)	2 Hexanone (µg/L)	2-Methyl 2-Pentanone (µg/L)	GRO (mg/L)	Lead (unf) (µg/L)	Lead(fil) (µg/L)	Methylene Chloride (µg/L)
		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ESMP-2D	Dec-95	ND	ND	ND	ND	ND	ND	ND	14	ND	ND	ND	ND	ND	ND	ND	1.8 J
ESMP-2D (DUPE)	Dec-95	ND	ND	ND	ND	ND	ND	ND	13	ND	ND	ND	ND	ND	ND	ND	ND
ESMP-3D	Dec-95	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ESMP-4S	Dec-95	ND	ND	ND	ND	ND	ND	ND	ND	ND	3.3 JB	ND	ND	ND	ND	ND	1.5 JB
ESMP-4D	Dec-95	ND	ND	ND	ND	ND	15	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ESMP-6D	Dec-95	ND	ND	ND	ND	ND	2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ESMP-8S	Dec-95	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ESMP-10S	Dec-95	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ESMP-13S	Dec-95	270	8.9J	140	90	509	ND	410	ND	ND	ND	ND	ND	4.8 E/ 5D	ND	ND	ND
ESMP-14D	Dec-95	ND	ND	ND	ND	ND	ND	4.2 J	ND	ND	ND	ND	ND	ND	ND	ND	ND
ESMP-16S	Dec-95	38	ND	13	15	66	ND	ND	ND	ND	4.6 JB	ND	ND	0.49	ND	ND	ND
ESMP-16D	Dec-95	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.064	ND	ND	ND
ESMP-17S	Dec-95	ND	ND	ND	ND	ND	930 E/1200 D	1400 E/4500 D	ND	ND	63 JBD	ND	ND	1.1	ND	ND	1.7 J
ESMP-17S (DUPE)	Dec-95	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-3	Dec-95	ND	ND	ND	ND	ND	ND	ND	ND	1.6 JB	2 JB	1.6 JB	ND	ND	ND	ND	ND
MW-4	Dec-95	ND	ND	ND	ND	ND	ND	ND	ND	3.9 JB	3.8 JB	3.1 JB	2.2 JB	ND	ND	ND	ND
MW-5	Dec-95	ND	12J	140	190	342	ND	ND	ND	ND	ND	ND	ND	14 E/14 D	ND	ND	ND
MW-6	Dec-95	ND	ND	ND	ND	ND	ND	28	180	ND	1.8 JB	ND	ND	0.097	ND	ND	ND
MW-8	Dec-95	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	5.70	5 B	ND
MW-11	Dec-95	ND	ND	ND	ND	ND	ND	ND	ND	2.2 JB	4.1 JB	ND	1.5 J	ND	5 B	5 B	ND
MW-12	Dec-95	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-12 (DUPE)	Dec-95	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

(a) ND = not detected.
(b) BLQ = below limit of quantitation.
(c) NA = not analyzed.
(d) BCL = below calibration limit (1.0 µg/L).
(e) ACL = above calibration limit (5000 µg/L).

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Table 8

Organic Chemicals Detected in Groundwater
March, 1996
Hazardous Waste Storage Area
Rickenbacker ANGB,Ohio

Sample Location	Sample Date	Benzene (µg/L)	Toluene (µg/L)	Ethylbenzene (µg/L)	Total Xylenes (µg/L)	Total BTEX (µg/L)	Vinyl Chloride (µg/L)	1,2-DCE (Total) (µg/L)	TCE (µg/L)	2-Butanone (µg/L)	Acetone (µg/L)
ESMP-2D	Mar-96	ND	ND	ND	ND	ND	ND	ND	9	ND	ND
ESMP-3D	Mar-96	ND	ND	ND	ND	ND	ND	ND	ND	ND	7.2 J
ESMP-4S	Mar-96	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ESMP-4D	Mar-96	ND	ND	ND	ND	ND	19	ND	ND	ND	2.1 J
ESMP-6D	Mar-96	ND	ND	ND	ND	ND	1.9 J	ND	ND	ND	1.7J
ESMP-8S	Mar-96	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ESMP-10S	Mar-96	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ESMP-13S	Mar-96	280	8.2 J	120	34	440	62	440	ND	ND	ND
ESMP-14D	Mar-96	ND	ND	ND	ND	ND	ND	5.80	ND	ND	ND
ESMP-16S	Mar-96	18	ND	ND	ND	18	ND	ND	ND	ND	1.6 JB
ESMP-16D	Mar-96	ND	ND	ND	ND	ND	ND	ND	ND	ND	6.6 J
ESMP-17S	Mar-96	ND	ND	ND	ND	ND	570 E/690 D	990E	ND	ND	55 JBD
ESMP-17S (DUPE)	Mar-96	ND	ND	ND	ND	ND	670	2900	ND	ND	55 JB
MW-3	Mar-96	ND	ND	ND	ND	ND	ND	ND	ND	ND	7.7 J
MW-4	Mar-96	ND	ND	ND	ND	ND	ND	ND	ND	2 J	11
MW-5	Mar-96	ND	4.8 J	54	100	59	ND	ND	ND	ND	ND
MW-6	Mar-96	ND	ND	ND	ND	ND	ND	ND	11	ND	1.7 J
MW-8	Mar-96	ND	ND	ND	ND	ND	ND	ND	ND	ND	4.4 J
MW-11	Mar-96	ND	ND	ND	ND	ND	ND	ND	ND	ND	7.6 J
MW-12	Mar-96	ND	ND	ND	ND	ND	ND	ND	ND	ND	2 J
MW-12 (DUPE)	Mar-96	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.7 J

(a) ND = not detected.
(b) BLQ = below limit of quantitation.
(c) NA = not analyzed.
(d) BCL = below calibration limit (1.0 µg/L).
(e) ACL = above calibration limit (5000 µg/L).

Table 9
Natural Attenuation Groundwater Geochemical Data
February, 1995
Hazardous Waste Storage Area
Rickenbacker ANGB, Ohio
Page 1 of 2

Sample Number	Sample Date	Water Temp. (°C)	pH	Conductivity (μmhos/cm)	Dissolved Oxygen (mg/L)	Redox Potential (mV)	Total Alkalinity (mg/L)	Hydrogen Sulfide (mg/L0	Ferrous Iron (mg/L)	Chloride (mg/L)	Sulfate (mg/L)	NO_2+NO_3 Nitrogen (mg/L)	TOC (mg/L)	Methane (mg/L	Ethene (mg/L)	CO_2 (mg/L)	NH_3 (mg/L)
ESMP-1D	02/28/95	11.4	7.22	703	0.6	190	336	NA[a]	0.1	10.2	41.4	<0.05	3.3	0.058	ND[b]	170	0.22
ESMP-2D	02/28/95	12.4	7.16	761	0.0	-63.3	344	NA	1.3	13.1	56.7	0.09	2.6	0.067	ND	190	0.1
ESMP-3S	02/28/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
ESMP-3D	02/28/95	12.4	7.06	810	0.0	-16.7	389	NA	1	10.9	52.8	0.05	1.6	0.067	ND	216	0.11
ESMP-4S	02/28/95	NA	6.98	965	NA	23.1	378	NA	0.8	5.1	144	0.08	2.7	0.109	ND	186	0.1
ESMP-4D	02/28/95	10.2	7.02	874	0.7	140	394	NA	0.1	7.31	87.1	0.08	2.6	0.015	0.001	220	0.06
ESMP-5S	02/27/95	12.1	7.3	730	0.8	200	293	NA	<0.05	4.91	55.8	7.94 ✓	1.7	0.002	ND	150	<.05
ESMP-5D	02/27/95	13.9	7.07	751	0.3	-45.8	370	<0.1	1.9	9.04	38.5	0.07	2	0.106	ND	228	0.17
ESMP-6D	02/28/95	13.5	7.18	840	0.1	-24.4	385	<0.1	0.9	10.3	61.5	0.09	4.1	0.079	ND	168	5.92
ESMP-7S	02/28/95	8.2	7.33	632	0.2	199	296	NA	0.1	8.24	32.7	1.78	4.4	0.017	ND	124	0.49
ESMP-7D	02/28/95	12.5	7.29	703	0.4	-53.5	212	<0.1	1.6	18.8	54.5	0.09	5	0.478	ND	208	0.12
ESMP-8S	02/27/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.23	5.1	0.003	ND	NA	0.07
ESMP-8D	02/27/95	NA	7.1	779	NA	-93.8	380	<0.1	3.1	NA	NA	NA	NA	NA	NA	100	NA
ESMP-8D[c]	02/27/95	NA	7.08	781	NA	-89.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
ESMP-8DD	02/27/95	14.4	NA	NA	0.5	NA	NA	NA	NA	7.26	54.5	0.07	1.3	0.006	ND	NA	0.19
ESMP-8DD(D)	02/27/95	NA	NA	NA	NA	NA	NA	NA	NA	7.33	55	NA	1.3	NA	NA	NA	NA
ESMP-9S	02/28/95	NA	7.13	799	NA	115	254	NA	0.1	7.2	48.1	5.75	7.2	0.015	ND	188	0.34
ESMP-9S(D)	02/28/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5.95	4.8	0.016	ND	NA	0.32
ESMP-9D	02/28/95	12.8	7.11	803	0.0	2.7	393	<0.1	0.8	6.3	65	0.08	1.6	0.008	ND	150	<.05
ESMP-9D(D)	02/28/95	NA	7.1	817	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
ESMP-10S	02/27/95	NA	7.22	667	NA	152	314	NA	0.3	5.05	44.2	2.75	2.9	0.003	ND	192	0.05
ESMP-10D	02/27/95	NA	7.01	823	0.1	-30	426	<0.1	1.8	8.21	36.1	0.11	3.9	0.12	ND	296	0.06
ESMP-11D	02/27/95	14	7.09	786	1.1	-70.1	376	<0.1	2.5	5.11	57.8	0.08	2.6	0.105	ND	220	0.07
ESMP-11D(D)	02/27/95	NA	NA	NA	NA	NA	NA	NA	NA	5	58.9	NA	2.6	NA	NA	NA	NA
ESMP-13S	02/28/95	8.1	7.21	841	0.3	-136	386	0.1	3.2	23.5	38.3	0.09	27.6	7.83	0.001	330	0.43
ESMP-13S(D)	02/28/95	NA	NA	NA	NA	NA	NA	NA	NA	23.3	38.2	NA	NA	NA	NA	NA	NA
ESMP-13D	02/28/95	11.1	7.14	775	0.5	-136	364	0.1	1.5	17	54.9	0.09	2.1	0.11	ND	170	0.07
ESMP-13D(D)	02/28/95	NA	NA	NA	NA	NA	NA	NA	NA	17.8	57.9	0.09	2.1	0.114	ND	NA	0.07
ESMP-14S	02/28/95	11.6	7.28	760	0.2	-115	440	<0.1	3.2	7.29	19.2	0.09	3.1	0.462	ND	288	0.13
ESMP-14S(D)	02/28/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.09	3.1	NA	NA	NA	0.12
ESMP-14D	02/28/95	12.1	7.09	767	0.2	-116	393	<0.1	1.4	17	58.7	0.11	3.2	0.106	ND	214	0.09

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Table 9
Natural Attenuation Groundwater Geochemical Data
February, 1995
Hazardous Waste Storage Area
Rickenbacker ANGB, Ohio
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Sample Number	Sample Date	Water Temp. (°C)	pH	Conductivity (μmhos/cm)	Dissolved Oxygen (mg/L)	Redox Potential (mV)	Total Alkalinity (mg/L)	Hydrogen Sulfide (mg/L0	Ferrous Iron (mg/L)	Chloride (mg/L)	Sulfate (mg/L)	NO_2+NO_3 Nitrogen (mg/L)	TOC (mg/L)	Methane (mg/L	Ethene (mg/L)	CO_2 (mg/L)	NH_3 (mg/L)
ESMP-14D(D)	02/28/95	NA	NA	NA	NA	NA	NA	NA	NA	16.3	57.1	0.11	3.6	NA	NA	NA	0.08
ESMP-15S	02/28/95	11.8	7.55	731	0.2	-95	185	<0.1	1.1	16.1	206	0.32	97	0.136	ND	136	0.19
ESMP-15S(D)	02/28/95	NA	NA	NA	NA	NA	NA	NA	NA	15.6	206	NA	NA	0.129	ND	NA	NA
ESMP-15D	02/28/95	9.3	8.22	764	1.2	72.1	103	NA	0.6	20.1	264	0.41	114.2	0.007	ND	90	0.1
ESMP-16S	03/01/95	11.9	7	2150	0.0	-143	522	<0.1	14.8	53.3	208	<0.05	523	3.067	ND	510	1.22
ESMP-16D	03/01/95	13.8	6.94	2070	0.0	-170	443	0.5	5.7	19.5	938	<0.05	61.3	1.15	ND	422	0.75
ESMP-16D(D)	03/01/95	NA	6.95	2080	NA	-172	NA	NA	NA	20.7	895	<0.05	NA	1.182	ND	NA	0.74
ESMP-17S	02/28/95	11.3	7.24	773	0.2	-125	380	<0.1	4.5	7.26	41	0.09	2	2.296	0.057	190	0.29
MW-2	03/01/95	10.8	7.16	832	0.5	212	389	NA	<0.05	7.79	61.2	0.09	5.3	0.661	ND	256	0.05
MW-3	02/28/95	10.1	7.08	943	1.8	212	368	NA	<0.05	21.1	127	0.1	4.6	0.003	ND	276	0.06
MW-3(D)	02/28/95	NA	7.1	961	NA	213	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-4	03/01/95	10.7	6.95	859	1.5	210	402	NA	<0.05	19	103	0.15	7.2	0.002	ND	316	0.09
MW-4(D)	03/01/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.15	NA	NA	NA	NA	0.09
MW-5	03/01/95	NA	7.07	942	NA	-115	416	NA	16.5	8	6.57	0.08	139.6	7.693	ND	478	0.45
MW-5(D)	03/01/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.178	ND	NA	NA
MW-6	02/28/95	10.5	6.96	1017	0.4	181	387	NA	<0.05	NA	NA	NA	5.5	0.013	ND	226	NA
MW-6(D)	02/28/95	NA	6.98	1057	NA	178	NA	NA	NA	NA	NA	NA	5.6	NA	NA	NA	NA
MW-8	02/28/95	10.3	7.34	719	4.1	209	391	NA	<0.05	8	20	0.06	13.4	0.015	ND	208	0.1
MW-9	03/01/95	8.9	6.82	1596	0.2	19.1	480	NA	2.4	18.9	496	0.08	7.6	0.004	ND	412	0.27
MW-9(D)	03/01/95	NA	NA	NA	NA	NA	NA	NA	NA	20	498	NA	7.6	NA	NA	NA	NA
MW-10	03/01/95	13.2	7.11	1172	0.0	-92.1	390	<0.1	2.2	23.4	296	0.07	5.7	0.04	ND	258	0.49
MW-11	02/28/95	11.4	7.38	566	3.9	194	211	NA	<0.05	5.65	44.8	9.1	1	BLQ[d]	ND	94	<.05
MW-12	02/28/95	12.4	7.04	854	0.6	38.6	347	NA	0.3	19.8	187	0.57	3.5	0.001	ND	300	<.05
MW-12(D)	02/28/95	NA	NA	NA	NA	NA	NA	NA	NA	13.3	91.7	NA	3.6	NA	NA	NA	NA

(a) NA = not available.
(b) ND = not detected.
(c) (D) = duplicate sample.
(d) BLQ = below lower limit of quantitation (0.001 μg/L).

Table 10
Natural Attenuation Groundwater Geochemical Data
August, 1995
Hazardous Waste Storage Area
Rickenbacker ANGB, Ohio

Sample Number	Sample Date	Water Temp. (°C)	pH	Conductivity (µmhos/cm)	Dissolved Oxygen (mg/L)	Redox Potential (mV)	Total Alkalinity (mg/L)	Sulfide (mg/L)	Ferrous Iron (mg/L)	Chloride (mg/L)	Sulfate (mg/L)	NO_2+NO_3 Nitrogen (mg/L)	Methane (mg/L	Ethane (mg/L)	Ethene (mg/L)	NH_3 (mg/L)
ESMP-2D	Aug-95	17.1	6.76	740	0.6	-59	350	0.007	1.51	9.2	44.5	0.03	0.074	ND	ND	ND
ESMP-3D	Aug-95	16.4	6.78	798	1.3	-51	381	0.006	1.26	9.2	50	0.04	0.063	ND	ND	ND
ESMP-4S	Aug-95	23.6	6.58	NA	0.8	83	486	0.648	NA	6.1	227	0.03	0.414	ND	ND	ND
ESMP-4D	Aug-95	17.5	6.66	905	1.4	57	400	0.113	0.65	6	96.3	0.04	0.039	ND	0.004	ND
ESMP-6D	Aug-95	19.8	6.7	839	1.3	-31	379	0.006	1.32	10	55.8	0.1	0.08	ND	ND	ND
ESMP-8S	Aug-95	25.3	7.54	578	6.7	156	331	0.283	0.37	3.7	27.8	0.21	ND	ND	ND	ND
ESMP-10S	Aug-95	22.7	7.31	687	6.4	159	301	0.421	NA	2.9	42.7	0.93	ND	ND	ND	0.37
ESMP-13S	Aug-95	17.2	6.96	NA	0.4	-125	374	0.011	2.72	16	6.09	0.04	19.163	0.006	0.002	0.39
ESMP-14D	Aug-95	16.1	6.73	46	0.7	-89	350	0.044	1.58	15.3	48.6	0.05	0.138	ND	ND	ND
ESMP-16S Just	Aug-95	19.1	6.82	NA	0.4	-134	430	0.012	2.94D	21.2	939	0.05	5.344	ND	ND	0.65
ESMP-16D "D"	Aug-95	19	6.74	44	0.8	-126	424	0.028	2.34D	NA	NA	NA	0.357	ND	ND	ND
ESMP-17S	Aug-95	17.9	6.97	NA	0.5	-113	368	0.017	2.69	5.6	38.3	0.04	2.73	ND	0.057	ND
ESMP-4D(~~Dupe~~)	Aug-95	NA	NA	NA	NA	NA	500	NA	NA	NA	NA	NA	NA	NA	NA	NA
ESMP-6D(~~Dupe~~)	Aug-95	NA	NA	NA	NA	NA	480	0.005	1.33	NA	NA	NA	NA	NA	NA	NA
ESMP-10S(~~Dupe~~)	Aug-95	NA	NA	NA	NA	NA	400	0.386	NA	NA	NA	NA	NA	NA	NA	NA
ESMP-13S(~~Dupe~~)	Aug-95	NA	NA	NA	NA	NA	460	0.009	2.84	NA	NA	NA	NA	NA	NA	NA
MW-3	Aug-95	17	6.7	776	1.8	157	387	0.078	0.37	16	72	0.05	ND	ND	ND	ND
MW-4	Aug-95	18.4	6.52	800	2.0	231	446	0.051	0.07	2.2	89	0.05	ND	ND	ND	ND
MW-5	Aug-95	NA	NA	NA	NA	NA	391	0.365	2.62	3.8	19.4	0.11	0.33	ND	ND	1.1
MW-6	Aug-95	17.5	6.57	833	1.1	41	409	0.27	0.43	9.4	129	0.17	ND	ND	ND	ND
MW-8	Aug-95	18.8	6.69	753	4.3	233	383	0.261	0.42	1.9	15.7	0.04	ND	ND	ND	ND
MW-11	Aug-95	18.2	7.01	560	4.7	178	275	0.118	0.24	2.7	49.7	1.7	ND	ND	ND	0.31
MW-12	Aug-95	17.4	6.81	834	1.0	143	480	0.091	1.1	NA	NA	NA	ND	ND	ND	NA

(a) NA = not available.

(b) ND = not detected.

(c) (D) = duplicate sample.

(d) BLQ = below lower limit of quantitation (0.001 µg/L).

D = Sample Diluted

Table 11
Natural Attenuation Groundwater Geochemical Data
December, 1995
Hazardous Waste Storage Area
Rickenbacker ANGB, Ohio

Sample Number	Sample Date	Water Temp. (°C)	pH	Conductivity (μmhos/cm)	Dissolved Oxygen (mg/L)	Redox Potential (mV)	Total Alkalinity (mg/L)	Sulfide (mg/L)	Ferrous Iron (mg/L)	Chloride (mg/L)	Sulfate (mg/L)	NO_2+NO_3 Nitrogen (mg/L)	Methane (mg/L	Ethene (mg/L)	Ethane	NH_3 (mg/L)
ESMP-2D	Dec-95	11.7	7.25	731	NA	-63	350	0.003	NT	7.8	47	0.1	0.075	ND	ND	0.25
ESMP-3D	Dec-95	12.2	8.31	808	2.7	-31	390	0.024	1.11	7.2	50	ND	0.039	ND	ND	0.2
ESMP-4S	Dec-95	12.2	8.69	1235	2.3	127	650	0.390D	0.48	8.3	290	ND	0.344	ND	ND	0.15
ESMP-4D	Dec-95	12.2	8.62	936	1.9	52	400	0.039	0.28	4.5	120	ND	0.164	ND	ND	ND
ESMP-6D	Dec-95	13.6	7.02	810	NA	-11	380	NA	1.39	8.3	53	ND	0.08	ND	ND	ND
ESMP-8S	Dec-95	10.3	8.58	601	3.5	125	280	0.212	0.41	1.5	29	ND	ND	ND	ND	0.29
ESMP-10S	Dec-95	11	8.53	660	3.1	65	340	0.164	0.27	2.3	40	1.6	ND	ND	ND	0.23
ESMP-13S	Dec-95	12.5	7.36	762	NA	-90	390	0.003	2.54	17	1.8	ND	15.36	ND	0.014	0.22
ESMP-14D	Dec-95	11.5	7.43	759	NA	-41	360	0.015	1.34	9.1	51	ND	0.117	ND	ND	ND
ESMP-16S	Dec-95	12.5	7.15	1978	NA	-111	560	0.024	2.05D	19	610	ND	9.278	ND	0.003	0.53
ESMP-16D	Dec-95	12	7.11	1144	NA	-75	380	0.012	2.03	12	240	ND	0.341	ND	0.002	0.48
ESMP-17S	Dec-95	12.5	7.48	751	NA	-99	360	NA	2.21	3.6	48	ND	1.775	0.056	ND	0.13
MW-3	Dec-95	11.2	7.18	922	NA	82	420	0.013	0.02	12	87	1.2	ND	ND	ND	0.2
MW-4	Dec-95	10.1	7.06	863	NA	217	390	0.003	0.02	1.7	84	0.1	ND	ND	ND	0.11
MW-5	Dec-95	NA	NA	NA	NA	NA	470	0.019D	2.08D	8.3	22	0.1	2.493	ND	0.01	1.4
MW-6	Dec-95	11.1	8.44	919	4.1	151	340	0.09	0.17	9.5	140	1.3	ND	ND	ND	0.16
MW-8	Dec-95	10.6	7.44	746	NA	57	410	0.056	0.08	1.5	15	0.17	ND	ND	ND	ND
MW-11	Dec-95	12.4	8.4	554	5.8	241	240	0.003	0.02	2.4	41	2.9	ND	ND	ND	0.12
MW-12	Dec-95	14.1	6.93	899	NA	142	380	0.005	0.17	9.2	86	0.44	ND	ND	ND	ND

(a) NA = not available.
(b) ND = not detected.
(c) (D) = duplicate sample.
(d) BLQ = below lower limit of quantitation (0.001 μg/L).
D = Sample Diluted

g:\wp51\docs\costello\762970\table11.xls

Table 12
Natural Attenuation Groundwater Geochemical Data
March, 1996
Hazardous Waste Storage Area
Rickenbacker ANGB, Ohio

Sample Number	Sample Date	Water Temp. (°C)	pH	Conductivity (μmhos/cm)	Dissolved Oxygen (mg/L)	Redox Potential (mV)	Sulfide (mg/L)	Ferrous Iron (mg/L)	Methane (mg/L	Ethene (mg/L)	NH_3 (mg/L)	Ethane
ESMP-2D	Mar-96	10.3	7.35	543	6.1	NA	0.001	1.63	0.132	ND	0.1	ND
ESMP-3D	Mar-96	11.8	7.29	582	4.9	NA	0.002	1	0.049	ND	ND	ND
ESMP-4S	Mar-96	8.4	7.25	612	4.3	NA	0.389D	0.29D	ND	ND	ND	ND
ESMP-4D	Mar-96	9.7	7.2	636	4.2	NA	0.017	0.28	0.139	ND	ND	ND
ESMP-6D	Mar-96	13	7.31	609	4.8	NA	0.007	1.46	0.082	ND	ND	ND
ESMP-8S	Mar-96	7	7.76	375	9.5	NA	0.559	0.32	ND	ND	0.1	ND
ESMP-10S	Mar-96	9.3	7.58	439	6.7	NA	0.6	0.33	ND	ND	0.1	ND
ESMP-13S	Mar-96	11	7.46	555	5.5	NA	0.03	1.88D	18.139	0.005	0.5	0.021
ESMP-14D	Mar-96	10.7	7.42	531	6.3	NA	0.005	1.41	0.119	ND	ND	ND
ESMP-16S	Mar-96	9	7.38	1435	6.1	NA	0.146	2.41D	4.701	ND	0.6	ND
ESMP-16D	Mar-96	10.5	7.41	820	6.8	NA	0.008	2.35	0.251	ND	0.4	ND
ESMP-17S	Mar-96	10.2	7.57	518	5.3	NA	0.004	3.27	2.576	0.004	0.1	0.003
MW-3	Mar-96	8.8	7.38	631	13.4	NA	0.032	0.05	ND	ND	0.1	ND
MW-4	Mar-96	7.4	7.35	446	12.8	NA	0.001	0.01	ND	ND	0.1	ND
MW-5	Mar-96						0.041D	0.56D	0.186	ND	0.3	ND
MW-6	Mar-96	7.6	7.38	456	9.6	NA	0.019	0.04	ND	ND	ND	ND
MW-8	Mar-96	7.5	7.42	483	6.8	NA	0.067	0.12	0.081	ND	0.1	ND
MW-11	Mar-96	9.4	7.28	594	5.2	NA	0.002	0.01	ND	ND	ND	ND
MW-12	Mar-96	9.6	7.38	625	6.2	NA	0.002	0.11	ND	ND	ND	ND
MW-12(Dupe)	Mar-96	NA	NA	NA	NA	NA	0.001	0.11	ND	ND	ND	ND
ESMP-17S(Dupe)	Mar-96	NA	NA	NA	NA	NA	0.003	3.25	2.416	0.045	0.1	0.008

(a) NA = not available.
(b) ND = not detected.
(c) (D) = duplicate sample.
(d) BLQ = below lower limit of quantitation (0.001 μg/L).
D = Sample Diluted

APPENDIX D

LABORATORY REPORTS FROM USEPA, 1995 AFCEE-SPONSORED NATURAL ATTENUATION INVESTIGATION

MANAGEMENT TECHNOLOGY

Ref: 95-DK9/vg
May 9, 1995

Dr. Don Kampbell
R.S. Kerr Environmental Research Lab
U.S. Environmental Protection Agency
P.O. Box 1198
Ada, OK 74820

THRU: S.A. Vandegrift SV

Dear Don:

This report contains the results of my GC/MSD analysis of methylene chloride extracts of core samples and one free floating product sample (MW-5) from Rickenbacker ANGB for quantitation of benzene, trichloroethylene (TCE), tetrachloroethylene (PCE), toluene, ethylbenzene (EB), p-Xylene (p-X), m-Xylene (m-X), o-Xylene (o-X), 1,3,5-trimethylbenzene (1,3,5-TMB), 1,2,4-trimethylbenzene (1,2,4-TMB), 1,2,3-trimethylbenzene (1,2,3-TMB), 1,2,4,5-tetramethylbenzene, 1,2,3,5-tetramethylbenzene, 1,2,3,4-tetramethylbenzene, naphthalene, 2-methylnaphthalene and 1-methylnaphthalene performed under Service Request #SF-1-118.

The analytical method was a modification of RSKSOP-124. Cool (38°C) on-column injection (0.5 μl) was used with electronic pressure control set for a constant flow of 0.9 ml/min. A 30M X 0.25 mm Restek Stabilwax (Crossbonded Carbowax-PEG, 0.5 μm film) capillary GC column with 9 inch long X 0.53 mm ID uncoated capillary precolumn was used. Quantitation was based on calibration curves of selected target ions (2 or 3 ions , total area) for each compound. A high level (5-250 μg/ml , naphthalenes 0.1-50 ug/ml) and low level (0.05-5 μg/ml) calibration curve was applied to each sample for quantitation. Complete reports detailing the acquisition method and calibration curves have been recorded. The soil samples were extracted by Mark Blankenship on March 6, 1995 and the free-floating product was received March 2, 1995. All samples were analyzed by GC/MSD on March 15-16, 1995.

If I can be of further assistance, please feel free to contact me.

Sincerely,

David A. Kovacs

David A. Kovacs

xc: R.L. Cosby
J.L. Seeley
G.B. Smith

Rickenbacker ANGB Free Product (ug/ml) and Soil Extracts (mg/kg)

Sample	Benzene	TCE	PCE	Toluene	Ethylbenzene	p-Xylene	m-Xylene
QC (5 ug/ml)	4.81E+00	4.60E+00	4.71E+00	4.76E+00	4.79E+00	4.87E+00	4.77E+00
5.0 ug/ml	5.17E+00	4.81E+00	4.87E+00	5.06E+00	5.04E+00	5.14E+00	5.18E+00
MW-5 Free Product (ug/ml)	ND	ND	ND	9.51E+00	2.59E+02	2.80E+02	7.63E+01
50 chk	5.36E+01	4.98E+01	4.97E+01	5.27E+01	5.30E+01	5.20E+01	5.08E+01
0.1 ug/ml Naphthalenes	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Method Blank SF-1-118	ND	ND	ND	ND	ND	ND	ND
SS-1	ND	BLQ	BLQ	BLQ	ND	ND	BLQ
SS-2	2.06E-01	ND	ND	BLQ	4.48E-01	3.14E-01	7.00E-01
SS-3	ND	ND	ND	BLQ	BLQ	1.86E-02	3.08E-02
10 ug/ml Naphthalenes	N/A	N/A	N/A	N/A	N/A	N/A	N/A
250 ug/ml	2.46E+02	2.39E+02	2.38E+02	2.57E+02	2.62E+02	2.62E+02	2.63E+02
0.5 ug/ml	5.08E-01	5.17E-01	5.14E-01	5.17E-01	5.10E-01	4.97E-01	5.30E-01

BLQ <0.05 ug/ml except Naphthalenes <0.1 ug/ml

Analyst: D. A. Kovacs

SF-1-118 Dr. D. Kampbell

Rickenbacker ANGB Free Product (ug/ml) and Soil Extracts (mg/kg)

GC/MSD (SIM)

Sample	o-Xylene	1,3,5-TMB	1,2,4-TMB	1,2,3-TMB	1,2,4,5-MeBenzene	1,2,3,5-MeBenzene
QC (5 ug/ml)	4.81E+00	4.70E+00	4.64E+00	4.61E+00	N/A	N/A
5.0 ug/ml	5.08E+00	4.98E+00	5.00E+00	4.92E+00	4.71E+00	5.10E+00
MW-5 Free Product (ug/ml)	5.32E+01	4.20E+02	7.68E+02	3.02E+02	1.98E+02	4.45E+02
50 chk	5.31E+01	5.30E+01	5.33E+01	5.25E+01	5.08E+01	5.17E+01
0.1 ug/ml Naphthalenes	N/A	N/A	N/A	N/A	N/A	N/A
Method Blank SF-1-118	ND	ND	ND	ND	ND	ND
SS-1	ND	ND	ND	ND	ND	ND
SS-2	6.56E-02	1.21E-01	4.87E-01	1.35E-01	3.90E-02	6.93E-02
SS-3	2.10E-02	BLQ	2.48E-02	ND	BLQ	BLQ
10 ug/ml Naphthalenes	N/A	N/A	N/A	N/A	N/A	N/A
250 ug/ml	2.62E+02	2.71E+02	2.76E+02	2.70E+02	2.76E+02	2.72E+02
0.5 ug/ml	5.20E-01	5.12E-01	5.21E-01	5.20E-01	4.97E-01	5.01E-01

BLQ <0.05 ug/ml excep Naphthalenes <0.1 ug/ml

Anal . A. Kovacs

Sample	1,2,3,4-MeBenzene	Naphthalene	2-MeNaphthalene	1-MeNaphthalene
QC (5 ug/ml)	N/A	N/A	N/A	N/A
5.0 ug/ml	5.12E+00	N/A	N/A	N/A
MW-5 Free Product (ug/ml)	1.03E+03	3.45E+01	4.93E+00	3.21E+00
50 chk	5.44E+01	N/A	N/A	N/A
0.1 ug/ml Naphthalenes	N/A	1.00E-01	1.00E-01	9.93E-02
Method Blank SF-1-118	ND	ND	ND	ND
SS-1	BLQ	ND	ND	ND
SS-2	3.13E-02	8.35E-02	2.37E-02	2.33E-02
SS-3	BLQ	ND	ND	ND
10 ug/ml Naphthalenes	N/A	9.79E+00	9.81E+00	9.84E+00
250 ug/ml	2.72E+02	N/A	N/A	N/A
0.5 ug/ml	5.05E-01	N/A	N/A	N/A

BLQ <0.05 ug/ml except Naphthalenes <0.1 ug/ml

Analyst: D. A. Kovacs

SOILS FROM RICKENBACHER AFB FOR TOC (SR# SF-1-118)

SAMPLES	SOIL FILTRATES %OC	SOLIDS %OC	TOTAL SOIL %TOC	MEAN %TOC	TPH, mg oil/Kg	% moisture
SS-1-1	0.010	1.505	1.515	1.514	<50	13.7
SS-1-2	0.015	1.497	1.512			
SS-2-1	0.058	0.798	0.856	0.799	<50	17.2
SS-2-2	0.065	0.677	0.742			
SS-3-1	0.004	1.458	1.462	1.409	<50	13.3
SS-3-2	0.004	1.352	1.356			
LECO		1.020				

WPO33-I 7.7 MG/L
7.9 MG/L

TRUE VALUES: LECO = 1.00 +/- 0.04% C
WPO33-I = 7.70 MG/L OC

Don Kampbell

per Don Kampbell,
phone conversation
4/12/95

Core Samples

	Moisture, %	TPH mg Oil/Kg	TOC, %
SS-1	13.7	< 50	1.5
SS-2	17.2	< 50	0.8
SS-3	13.3	< 50	1.4

	MW-5 Product mg/ml		SS-1 (mg/Kg)	SS-2 (mg/Kg)	SS-3 (mg/Kg)
Benzene	< 5		< 5	< 5	< 5
Toluene	10			7	5
Ethylbenzene	240			282	5
p-xylene	250			198	11
[illegible]-xylene	76	377		443	19
o-xylene	51			41	12
1,3,5 TriMB	388			76	5
1,2,4 TriMB	740			309	16
1,2,3 TriMB	540			85	< 5
1,2,3,5 TetraMB	440			25	< 5
1,2,3,4 TetraMB	860			44	< 5
TCE	< 5			< 5	< 5
PCE	< 5			< 5	< 5

BTEX > TPH

Extractions

Jim Kampbell

4/14/95

wpdocs
fdrickAN.

File: Rickenbacker ANG?
722450.25

Field Data Rickenbacker ANG, Ohio					
Sample	Date	Carbon Dioxide mg/l	Total Alkalinity mg/l	Ferrous Iron mg/l	Hydrogen Sulfide mg/l
ES mp-5S	2-27-95	150	293	<.05	-
ES mp-5D	2-27-95	228	370	1.9	<.1
ES mp-10D	2-27-95	296	426	1.8	<.1
ES mp-10S	2-27-95	192	314	.3	-
ES mp-8D	2-27-95	100	380	3,1	<.1
ES mp-11D	2-27-95	220	376	2.5	<.1
ES mp-7S	2-28-95	124	296	.1	
ES mp-7D	2-28-95	208	212	1.6	<.1
ES mp-6D	2-28-95	168	385	.9	<.1
ES mp-9D	2-28-95	150	393	.8	<.1
ES mp-9S	2-28-95	188	254	.1	-
MW-12	2-28-95	300	347	.3	-
ES mp-3D	2-28-95	216	389	1.0	-
MW-6	2-28-95	226	387	<.05	
MW - 11	2-28-95	94	211	<.05	-
ES mp-4D	2-28-95	220	394	.1	-
ES mp-4S	2-28-95	186	378	.8	-
ES mp-14S	2-28-95	288	440	3.2	<.1
ES mp-14D	2-28-95	214	393	1.4	<.1
ES mp-2D	2-28-95	190	344	1.3	-
ES mp-1D	2-28-95	170	336	.1	-
MW-3	2-28-95	276	368	<.05	-
MW-8	2-28-95	208	391	<.05	-
ES mp-13S	2-28-95	330	386	3.2	.1

Sample	mg/L Cl^-	mg/L $SO_4^=$	mg/L $NO^-_2 + NO^-_3(N)$	mg/L NH_3
ESMP-1D	10.2	41.4	<.05	0.22
ESMP-2D	13.1	56.7	0.09	0.10
ESMP-4D	7.31	87.1	0.08	0.06
ESMP-4S	5.10	144	0.08	0.10
ESMP-13D	17.0	54.9	0.09	0.07
ESMP-13D Field Dup	17.8	57.9	0.09	0.07
ESMP-13S	23.5	38.3	0.09	0.43
ESMP-13S Dup	23.3	38.2	----	----
ESMP-14D	17.0	58.7	0.11	0.09
ESMP-14D Dup	----	----	0.11	0.08
ESMP-14D Field Dup	16.3	57.1	0.11	0.08
ESMP-14S	7.29	19.2	0.09	0.13
ESMP-14S Field Dup	- NO SAMPLE -		0.09	0.12
ESMP-15D	20.1	264	0.41	0.10
ESMP-15S	16.1	206	0.32	0.19
ESMP-15S Dup	15.6	206	----	----
ESMP-16D	19.5	938	<.05	0.75
ESMP-16D Field Dup	20.7	895	<.05	0.74
ESMP-16S	53.3	208	<.05	1.22
ESMP-17S	7.26	41.0	0.09	0.29
MW-2	7.79	61.2	0.09	0.05
MW-3	21.1	127	0.10	0.06
MW-4	19.0	103	0.15	0.09
MW-4 Dup	----	----	0.15	0.09
MW-5	8.00	6.57	0.08	0.45
MW-8	8.00	20.0	0.06	0.10
MW-9	18.9	496	0.08	0.27
MW-9 Dup	20.0	498	----	----
MW-10	23.4	296	0.07	0.49
Blank	<.5	<.5	<.05	<.05
WP032	106	75.1	2.51	2.08
WP032 T.V.	106	75.0	2.81	2.30
Spike Rec.	101%	95%	98%	100%

Sample	pH	Conductivity	Redox
ESMP-5S	7.30	730	200
ESMP-5D	7.07	751	-45.8
ESMP-10D	7.01	823	-30.0
ESMP-10S	7.22	667	152
ESMP-8D	7.10	779	-93.8
ESMP-8D Dup	7.08	781	-89.5
ESMP-11D	7.09	786	-70.1
ESMP-7S	7.33	632	199
ESMP-7D	7.29	703	-53.5
ESMP-6D	7.18	840	-24.4
ESMP-9D	7.11	803	2.70
ESMP-9D Dup	7.10	817	-----
ESMP-9S	7.13	799	115
MW-12	7.04	854	38.6
ESMP-3D	7.06	810	-16.7
MW-6	6.96	1017	181
MW-6 Dup	6.98	1057	178
MW-11	7.38	566	194
ESMP-4D	7.02	874	140
ESMP-4S	6.98	965	23.1
ESMP-14D	7.09	767	-116
ESMP-14S	7.28	760	-115
ESMP-2D	7.16	761	-63.3
ESMP-1D	7.22	703	190
MW-3	7.08	943	212
MW-3 Dup	7.10	961	213
MW-8	7.34	719	209
ESMP-13D	7.14	775	-136
ESMP-13S	7.21	841	-136
ESMP-17S	7.24	773	-125
ESMP-15S	7.55	731	-95.0
ESMP-15D	8.22	764	72.1
MW-2	7.16	832	212
MW-10	7.11	1172	-92.1
MW-5	7.07	942	-115
ESMP-16S	7.00	2150	-143
ESMP-16D	6.94	2070	-170
ESMP-16D Field D.	6.95	2080	-172
MW-9	6.82	1596	19.1
MW-4	6.95	859	210

GROUNDWATER SAMPLES FROM RICKENBACHER AFB FOR TOC & TIC (SR# SF-1-118)

SAMPLES	MG/L TC	MG/L OC	MG/L TIC
MW-2	112.0	5.3	106.7
MW-03	105.6	4.6	101.0
MW-4	112.4	7.2	105.2
MW-5	197.2	139.6	57.6
MW-6	-------------	5.5	-----------
MW-6 DUP	-------------	5.6	-----------
MW-9	150.0	7.6	142.4
MW-9 DUP	149.6	7.6	142.0
MW-8	105.2	13.4	91.8
MW-10	100.4	5.7	94.7
MW-11	56.0	1.0	55.0
MW-12	98.8	3.5	95.3
MW-12 DUP	98.8	3.6	95.2
ESMP-1D	92.0	3.3	88.7
ESMP-1D DUP	92.0	3.3	88.7
ESMP-2D	94.8	2.6	92.2
ESMP-3D	108.4	1.6	106.8
ESMP-4D	109.6	2.6	107.0
ESMP-4S	109.2	2.7	106.5
ESMP-5D	98.0	2.0	96.0
ESMP-5D DUP	98.4	2.0	96.4
ESMP-5S	82.0	1.7	80.3
ESMP-6D	112.0	4.1	107.9
ESMP-7D	83.6	5.0	78.6
ESMP-7S	83.2	4.4	78.8
ESMP-8DD	99.2	1.3	97.9
ESMP-8DD DUP	99.6	1.3	98.3
ESMP-8S	-------------	5.1	-----------
ESMP-8S DUP	-------------	5.3	-----------
ESMP-9D	108.0	1.6	106.4
ESMP-9S REP 1	95.6	7.2	88.4
ESMP-9S REP 2	95.6	4.8	90.8
ESMP-10D	122.4	3.9	118.5
ESMP-10S	83.2	2.9	80.3
ESMP-11D	100.4	2.6	97.8
ESMP-11D DUP	100.8	2.6	98.2
ESMP-13D	97.2	2.1	95.1
ESMP-13D DUP	97.2	2.1	95.1
ESMP-13S	129.6	27.6	102.0
ESMP-14D	96.0	3.2	92.8
ESMP-14D REP 3	96.0	3.6	92.4
ESMP-14S REP 1	107.6	3.1	104.5
ESMP-14S REP 1 DUP	107.6	3.1	104.5
ESMP-14S REP 3	107.6	3.7	103.9

SAMPLES	MG/L TC	MG/L OC	MG/L TIC
ESMP-15D	132.8	114.2	18.6
ESMP-15D DUP	132.8	115.0	17.8
ESMP-15S	134.0	97.0	37.0
ESMP-16D	156.4	61.3	95.1
ESMP-16S	594.0	523.0	71.0
ESMP-17S	104.0	2.0	102.0
WPO32-II	10.2 MG/L		
	10.3 MG/L		
	10.9 MG/L		
	9.5 MG/L		
	9.8 MG/L		
WPO33-I	7.7 MG/L		
	7.9 MG/L		

TRUE VALUE: WPO32-II = 9.9 MG/L
WPO33-I = 7.7 MG/L

SampleName	BENZENE	TOLUENE	ETHYLBENZENE	p-XYLENE	m-XYLENE	o-XYLENE	1,3,5-TMB	1,2,4-TMB	1,2,3-TMB	1,2,4,5-TETRA	1,2,3,5-TETRA	1,2,3,4-TETRA
100 PPB	101.52	101.31	101.85	101.75	101.59	101.49	104.75	101.72	101.49	103.59	103.75	103.53
QC, OBSERVED, PPB	53.37	52.37	49.45	51.27	50.40	51.84	51.07	51.17	52.80	46.48	51.01	48.49
QC, TRUE VALUE, PPB	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
MW-2	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	1.03	BLQ	ND	ND	0.97
MW-3	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	ND	ND	ND
MW-4	BLQ	BLQ	BLQ	BLQ	BLQ	ND	BLQ	ND	ND	ND	ND	ND
MW-4 Duplicate	BLQ	BLQ	BLQ	BLQ	ND	ND	ND	ND	ND	ND	ND	1.30
MW-5	17.19	41.94	317.97	229.22	91.23	55.48	59.44	208.63	77.96	15.01	36.23	71.99
MW-6	1.67	BLQ	BLQ	BLQ	BLQ	ND	ND	ND	ND	ND	ND	ND
MW-8	BLQ	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-9	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-10	ND	ND	ND	ND	ND	ND	ND	ND	BLQ	ND	ND	ND
MW-11	ND	ND	ND	ND	ND	ND	BLQ	ND	ND	ND	ND	ND
10 PPB	9.91	9.80	9.80	9.74	9.86	10.03	9.69	9.56	9.80	9.29	9.34	9.11
MW-12	ND	BLQ	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ESMP-1D	ND	BLQ	BLQ	ND	ND	ND	ND	ND	ND	ND	ND	ND
ESMP-1S	ND	BLQ	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ESMP-2D	ND	1.05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ESMP-3D	ND	BLQ	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ESMP-3D Duplicate	ND	BLQ	BLQ	ND	ND	ND	ND	ND	ND	ND	ND	ND
ESMP-4D	ND	2.48	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ESMP-4S	ND	BLQ	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ESMP-5D	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ESMP-5S	ND	BLQ	BLQ	BLQ	ND	ND	ND	ND	ND	ND	ND	ND
ESMP-6D	ND	BLQ	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
500 PPB	498.59	496.60	498.93	497.67	498.24	499.48	495.16	495.94	497.71	484.56	489.47	485.47
ESMP-6S	ND	3.13	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ESMP-7D	BLQ	BLQ	BLQ	BLQ	ND	ND	BLQ	ND	ND	BLQ	BLQ	0.95
ESMP-7S	BLQ	BLQ	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ESMP-8S	ND	1.30	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.60
ESMP-8DD	ND	BLQ	ND	ND	BLQ	ND	ND	ND	ND	ND	ND	ND
ESMP-8DD Duplicate	ND	BLQ	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ESMP-9D	ND	BLQ	ND	ND	BLQ	ND	ND	ND	ND	ND	ND	ND
ESMP-9S	ND	BLQ	BLQ	ND	ND	ND	ND	ND	ND	ND	ND	ND
ESMP-10D	ND	BLQ	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ESMP-10S	ND	BLQ	ND	BLQ	BLQ	ND	ND	ND	ND	ND	ND	ND
GC LAB BLANK, PPB	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
QC, OBSERVED, PPB	55.36	54.07	50.85	52.91	53.28	53.92	52.39	51.88	52.98	45.16	50.36	48.87
QC, TRUE VALUE, PPB	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
ESMP-11D	BLQ	BLQ	BLQ	BLQ	ND	ND	ND	ND	ND	BLQ	BLQ	0.98
ESMP-12S	ND	2.44	BLQ	ND	ND	ND	ND	ND	ND	ND	ND	ND
ESMP-12S Duplicate	ND	2.50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ESMP-13D	ND	ND	BLQ	ND	ND	ND	ND	ND	ND	ND	ND	ND
ESMP-13S	424.18	22.41	237.09	106.99	163.61	8.98	14.28	62.49	39.14	4.61	8.85	15.71
ESMP-14D	ND	BLQ	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ESMP-14DD	ND	BLQ	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.64
ESMP-14S	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.06
ESMP-15D	ND	BLQ	ND	ND	BLQ	ND	ND	ND	ND	ND	ND	10.65
ESMP-15S	BLQ	1.08	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	1.41	12.88
100 PPB	102.11	101.76	102.08	100.97	103.04	101.77	104.58	101.52	101.47	102.62	103.02	103.29
ESMP-16D	6.46	BLQ	26.87	22.60	7.80	31.63	5.71	31.88	17.08	4.84	6.84	5.94
ESMP-16S	89.18	BLQ	228.50	44.20	18.02	91.43	8.42	62.76	57.44	22.71	32.54	34.07
ESMP-17S	BLQ	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
10 PPB	10.01	10.08	10.09	9.89	9.95	10.05	9.94	9.67	9.75	9.41	9.45	9.16

Table 1. Quantitation Report for S.R. # SF−1−118 from Rickenbacker.

Concentration = ppb

Compound	MW−2	MW−03	MW−4	MW−5	MW−6	MW−6 Field Dup 1/4 Dil	MW−8	MW−9	MW−10	MW−11	MW−11 Lab Dup
VINYL CHLORIDE	ND	ND	ND	ND	23.1	21.9	ND	ND	ND	ND	ND
1,1−DICHLOROETHENE	ND	ND	ND	ND	6.5	6.5	ND	ND	ND	ND	ND
T−1,2−DICHLOROETHENE	ND	ND	ND	ND	47.3	43.2	ND	ND	ND	ND	ND
C−1,2−DICHLOROETHENE	ND	−−−	ND	ND	873	794	ND	ND	ND	ND	ND
1,1,1−TRICHLOROETHANE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
CARBON TETRACHLORIDE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BENZENE	ND	ND	ND	12.4	2.3	2.2	ND	ND	ND	ND	ND
1,2−DICHLOROETHANE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TRICHLOROETHENE	ND	1.0	ND	ND	*******	9580	−−−	ND	ND	ND	−−−
TOLUENE	ND	ND	ND	32.7	−−−	ND	ND	ND	ND	ND	ND
TETRACHLOROETHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
CHLOROBENZENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ETHYLBENZENE	ND	ND	ND	306	ND	ND	ND	ND	ND	ND	ND
m+p−XYLENE	ND	ND	ND	312	ND	ND	ND	ND	ND	ND	ND
o−XYLENE	ND	ND	ND	52.6	ND	ND	ND	ND	ND	ND	ND

Compound	MW−12	MW−12 Field Dup	ESMP 1D	ESMP 1S	ESMP 2D	ESMP 2S	ESMP 03	ESMP 3D	ESMP 4D	ESMP 4S	ESMP 5D
VINYL CHLORIDE	ND	ND	ND	ND	ND	ND	ND	ND	16.0	1.0	ND
1,1−DICHLOROETHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
T−1,2−DICHLOROETHENE	ND	ND	ND	ND	1.0	ND	ND	ND	ND	ND	ND
C−1,2−DICHLOROETHENE	ND	ND	ND	ND	−−−	ND	−−−	1.3	ND	ND	ND
1,1,1−TRICHLOROETHANE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
CARBON TETRACHLORIDE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BENZENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2−DICHLOROETHANE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TRICHLOROETHENE	ND	−−−	ND	ND	95.6	ND	1.0	6.5	ND	ND	ND
TOLUENE	ND	ND	−−−	−−−	1.0	3.6	ND	−−−	1.5	−−−	ND
TETRACHLOROETHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
CHLOROBENZENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ETHYLBENZENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
m+p−XYLENE	ND	ND	ND	ND	ND	−−−	ND	ND	ND	ND	ND
o−XYLENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

ND = None Detected −−− = Below Calibration Limit(1.0 ppb) Dil = Dilution Dup = Duplicate ***** = Above Calibration Limit(5000 ppb)

Table 2. Quantitation Report for S.R. # SF-1-118 from Rickenbacker.

Concentration = ppb

Compound	ESMP 5S	ESMP 6D	ESMP 6D Lab Dup	ESMP 7D	ESMP 7S	ESMP 8DD	ESMP 8S	ESMP 9D	ESMP 9S	ESMP 10D	ESMP 10S
VINYL CHLORIDE	ND	1.7	2.0	ND	ND	ND	ND	ND	ND	ND	ND
1,1-DICHLOROETHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
T-1,2-DICHLOROETHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
C-1,2-DICHLOROETHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
CHLOROFORM	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,1-TRICHLOROETHANE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
CARBON TETRACHLORIDE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BENZENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-DICHLOROETHANE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TRICHLOROETHENE	ND	ND	ND	ND	ND	---	---	ND	---	ND	1.0
TOLUENE	ND	ND	ND	---	ND	---	1.0	ND	---	ND	---
TETRACHLOROETHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
CHLOROBENZENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ETHYLBENZENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
m+p-XYLENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
o-XYLENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Compound	ESMP 10S Lab Dup	ESMP 11D	ESMP 12S	ESMP 13D	ESMP 13D Field Dup	ESMP 13S	ESMP 14D	ESMP 14D Field Dup	ESMP 14DD	ESMP 14S	ESMP 14S Lab Dup
VINYL CHLORIDE	ND	ND	ND	ND	ND	2.7	1.0	1.0	ND	ND	ND
1,1-DICHLOROETHENE	ND	ND	ND	ND	ND	1.3	ND	ND	ND	ND	ND
T-1,2-DICHLOROETHENE	ND	ND	ND	ND	ND	300	ND	ND	ND	ND	ND
C-1,2-DICHLOROETHENE	ND	ND	ND	ND	ND	228	2.2	2.1	ND	ND	ND
CHLOROFORM	ND	ND	ND	ND	ND	---	ND	ND	ND	ND	ND
1,1,1-TRICHLOROETHANE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
CARBON TETRACHLORIDE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BENZENE	ND	ND	ND	ND	ND	423	ND	ND	ND	ND	ND
1,2-DICHLOROETHANE	ND	ND	220	ND	ND	ND	ND	ND	ND	ND	ND
TRICHLOROETHENE	1.0	ND	---	ND	ND	45.6	ND	ND	---	ND	ND
TOLUENE	---	ND	1.7	ND	ND	19.7	ND	ND	---	ND	ND
TETRACHLOROETHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
CHLOROBENZENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ETHYLBENZENE	ND	ND	ND	ND	ND	209	ND	ND	ND	ND	ND
m+p-XYLENE	ND	ND	ND	ND	ND	248	ND	ND	ND	ND	ND
o-XYLENE	ND	ND	ND	ND	ND	7.7	ND	ND	ND	ND	ND

ND = None Detected --- Below Calibration Limit(1.0 ppb) Dup = Duplicate

Table 3. Quantitation Report for S.R. # SF−1−118 from Rickenbacker.

Concentration = ppb

Compound	ESMP 15D	ESMP 15S	ESMP 16D	ESMP 16S	ESMP 17S	QC0307A 20 ppb	QC0307B 200 ppb	QC0307C 20 ppb	QC0307D 200 ppb	QC0307E 20 ppb	QC0307F 200 ppb
VINYL CHLORIDE	ND	ND	ND	ND	1570	22.3	222	20.3	Cracked	21.3	207
1,1−DICHLOROETHENE	ND	ND	ND	ND	11.7	23.0	226	20.4	Vial	20.8	203
T−1,2−DICHLOROETHENE	ND	ND	ND	ND	152	20.2	202	19.4	sample	20.1	191
C−1,2−DICHLOROETHENE	ND	ND	−−−	−−−	4913	19.0	201	20.5	lost	19.9	195
1,1,1−TRICHLOROETHANE	ND	ND	ND	ND	ND	22.0	219	19.7		20.0	200
CARBON TETRACHLORIDE	ND	ND	ND	ND	ND	22.7	222	19.6		20.6	198
BENZENE	ND	ND	6.2	82.7	ND	21.8	228	22.0		22.2	219
1,2−DICHLOROETHANE	ND	ND	ND	ND	ND	19.6	216	22.6		23.8	224
TRICHLOROETHENE	ND	ND	ND	ND	−−−	22.8	229	21.4		22.1	210
TOLUENE	ND	−−−	−−−	−−−	ND	20.9	210	21.1		20.6	197
TETRACHLOROETHENE	ND	ND	ND	ND	ND	22.9	221	19.6		19.8	197
CHLOROBENZENE	ND	ND	ND	ND	ND	21.2	214	22.6		21.7	212
ETHYLBENZENE	ND	ND	23.6	186	ND	21.4	211	18.9		20.3	194
m+p−XYLENE	ND	ND	26.0	48.2	ND	42.8 *	420 **	39.6 *		40.9 *	383 **
o−XYLENE	ND	ND	27.9	77.3	ND	20.3	208	20.3		20.8	202

Compound	QC0307G 20 ppb	QC0307H 200 ppb	QC0307I 20 ppb	QC0307J 200 ppb	QC0310A 20 ppb	QC0310B 200 ppb	BL0307A	BL0307B
VINYL CHLORIDE	20.8	201	21.9	196	22.0	200	−−−	−−−
1,1−DICHLOROETHENE	20.0	208	19.9	203	21.8	207	−−−	−−−
T−1,2−DICHLOROETHENE	19.4	192	19.3	202	19.9	189	−−−	−−−
C−1,2−DICHLOROETHENE	19.3	198	19.9	207	19.7	195	−−−	−−−
1,1,1−TRICHLOROETHANE	20.0	203	20.3	199	21.4	208	−−−	−−−
CARBON TETRACHLORIDE	20.0	205	20.5	203	21.1	209	−−−	−−−
BENZENE	20.9	225	22.2	224	22.6	218	−−−	−−−
1,2−DICHLOROETHANE	20.9	228	22.5	230	21.9	226	−−−	−−−
TRICHLOROETHENE	20.4	215	21.3	209	22.5	216	−−−	−−−
TOLUENE	20.7	202	20.6	199	20.7	203	−−−	−−−
TETRACHLOROETHENE	19.7	202	20.1	198	20.4	191	−−−	−−−
CHLOROBENZENE	20.9	213	21.7	215	22.0	212	−−−	−−−
ETHYLBENZENE	19.6	205	19.7	196	20.0	201	−−−	−−−
m+p−XYLENE	39.8 *	391 **	40.3 *	388 **	39.8 *	384 **	−−−	−−−
o−XYLENE	20.1	209	19.6	208	20.8	205	−−−	−−−

ND = None Detected   * = 40 ppb Std.   ** = 400 ppb Std.   QC = Quality Control Std.   BL = Blank   −−− = Below Calibration Limit(1.0 ppb)

units = mg/L

Lower quantitation limits:

methane = 0.001 mg/L

ethylene = 0.003 mg/L

per Don Kampbell phone conv.

4/12/95

ANALYZED 3/7/95

SAMPLE	METHANE	ETHYLENE
LAB BLANK	ND	ND
ESMP-3D	0.067	ND
ESMP-5D	0.106	ND
ESMP-5S	0.002	ND
ESMP-6D	0.079	ND
ESMP-7D	0.478	ND
ESMP-7S	0.017	ND
ESMP-8DD	0.006	ND
ESMP-8S	0.003	ND
ESMP-9D	0.008	ND
ESMP-9S	0.015	ND
" FIELD DUP	0.016	ND

ANALYZED 3/8/95

SAMPLE	METHANE	ETHYLENE
LAB BLANK	BLQ	ND
ESMP-10D	0.012	ND
ESMP-10S	0.003	ND
ESMP-11D	0.105	ND
MW6	0.013	ND
MW11	BLQ	ND
MW12	0.001	ND
ESMP-1D	0.058	ND
ESMP-2D	0.067	ND
ESMP-4D	0.015	0.001 = <0.003
ESMP-4S	0.109	ND
ESMP-13D	0.110	ND
" FIELD DUP	0.114	ND
ESMP-13S	7.830	0.001 = <0.003
ESMP-14D	0.106	ND
ESMP-14S	0.462	ND
ESMP-15D	0.007	ND
ESMP-15S	0.136	ND
" LAB DUP	0.129	ND
ESMP-16D	1.150	ND
" FIELD DUP	1.182	ND
ESMP-16S	3.067	ND
ESMP-17S	2.296	0.057
MW2	0.661	ND
MW3	0.003	ND
MW4	0.002	ND
MW5	7.693	ND
" LAB DUP	7.178	ND
MW8	0.015	ND
MW9	0.004	ND
MW10	0.040	ND

MANTECH ENVIRONMENTAL TECHNOLOGY

Ref: 95-DF20

April 17, 1995

Dr. Don Kampbell
R.S. Kerr Environmental Research Lab
U.S. Environmental Protection Agency
P.O. Box 1198
Ada, OK 74820

THRU: S.A. Vandegrift SV

Dear Don:

As requested in Service Request SF-1-118, GC/MS analysis for phenols and aliphatic/aromatic acids was done on one water sample labelled MW-5 from Rickenbacken ANGB. Liquid-liquid extraction was done by Mark Blankenship on April 6, 1995. The extract was analyzed by GC/MS on April 13, 1995. A SOP describing the extraction, derivatization and GC/MS analysis is in preparation.

Liquid-Liquid Extraction of Phenols and Aliphatic/Aromatic Acids.

For the extraction of the phenols and aliphatic/aromatic acids from the water sample, 100 ml of the water sample is placed in a dried, silanized 125 ml separatory funnel. Spike solutions if applicable were added to the sample at this time. The pH of the water is adjusted to 2.0 using 1:1 H_2SO_4. For a water blank without Na_3PO_4 added, a pH of 2 is reached with ten drops. For 100 ml of water sample preserved with Na_3PO_4, twenty drops of acid is required. Next 25 g of NaCl is added to the separatory funnel after which the liquid is swirled to dissolve the salt.

The water sample is extracted four times with 5 ml aliquots of acid free methylene chloride. To remove acids from methylene chloride and other solvents, 10 g of Celite Micro-Cel T-49 is added to one liter of GC/MS grade solvent. This mixture is stirred for one hour, allowed to settle and is filtered through a Millipore organic filter pad using Millipore vacuum apparatus. The methylene chloride extracts are collected in silanized 40 ml VOA vials. The total extract volume is recorded.

Phenol/Acid Derivatization to Form PFB Ethers and Esters.

A 200 µl aliquot of the methylene chloride extract is delivered to a 2 ml screw cap vial containing 2.5 mg of dried potassium carbonate. Next 790 µl of acid free acetonitrile, 10 µl of 100 ppm benzoic acid-d_5 and 10 µl of pentafluorobenzyl bromide is added to the vial. Benzoic acid-d_5 is the internal standard for the analysis. The vials are momentarily placed in a sonic bath to free the solid salt from the bottom of the vial. The screw caps of the vials are tightened and the vials are heated in a oven at 60°C for 2 hours. When the vials are removed from the oven, 500 µl of 0.1M Hcl is added. The vials are shaken for 30 seconds and 200 µl of the top organic layer is delivered to the liner of a 2 ml crimp cap autosampler vial.

Negative Ion Chemical Ionization GC/MS Analysis of PFB-Derivatives.

For negative ion chemical ionization GC/MS, a chemical ionization ion volume is placed in the ion source block of the Finnigan 4615 GC/MS. Methane gas is regulated using a needle valve until the ionizer pressure reaches 0.40 torr. With the ionizer at this pressure, the high vacuum pressure indicates 1.0×10^{-5} torr. The mass spectrometer is tuned using the calibration gas, FC-43, to obtain good peak shape for ions 414 and 633 m/z and a relative intensity of 100:14:4 for ions 633, 414 and 127 m/z. The ion source is heated at 150°C. The injector and transfer lines are held at 275°C.

The Hewlett Packard 7673 autoinjector delivered 0.5 µl of the sample or standard to the GC injection port. A splitless injection for 1 minute was used for the analysis. The analytical column was a 60 meter, 0.25 mm J&W DB5-MS capillary column with 0.25 µm film thickness. The column was temperature programmed from 50°C to 100°C at 30°C/min and then to 300°C at 6°C/min. The helium linear velocity measured with air was 36 cm/s when the oven temperature was 100°C and the helium head pressure on the column was 29 psi. The Finnigan 4615 GC/MS was scanned from 42 to 550 m/z in 0.5 sec.

Standard curves are prepared using a mixture containing thirteen phenols, twenty-five aliphatic acids and nineteen aromatic acids. Calibration curves for acetic acid was not prepared due to artefact levels of this acid in solvents. Derivatization of the standard solutions and samples was done in the same manner. Standards are prepared at 5, 10, 25, 50, 100, 500 and 1000 ppb. Quality assurance was maintained during the sample analysis by running check standards, derivatization blanks, extraction banks, extraction recovery check standards and spiked field samples.

Quantitative Results of Phenols and Aliphatic/Aromatic Acids.

Table I provides the concentrations of phenols and aliphatic/aromatic acids found in the water sample taken at the Rickenbacken ANGB site and quality assurance samples run at the same time as the samples. The lowest reported value of phenol or acid in this table is at or about 5 ppb.

Spike recoveries for each of the acids and phenols were determined in 50 ppb spikes of 100 ml of water blank. Recovery of the 50 ppb concentration was poor for low molecular weight aliphatic acids due to the poor extraction efficiencies of these acids from water. Higher molecular weight aliphatic acids and all the phenols and aromatic acids exhibit good recoveries.

Sample MW5 contained high levels of lower molecular weight acids and branched heptanoic and octanoic acids. The branched octanoic acids are present in the water sample at or above 1 ppm. These compounds are labelled in the attached chromatograms. One chromatogram shows the extracted ion profile of C_6, C_7, C_8 and C_9 branched chain acids. The extracted ion for each corresponds to the carboxylate ion of each acid. Also included please find extracted ion profiles for m/z ions 141 and 155. The 141 ion could correspond to octenoic acids, methylcyclohexanecarboxylic acids or dimethylcyclopentanecarboxylic acids. Compounds such as nonenoic acids or dimethyl-(or ethyl)cyclohexenecarboxyic acids could give carboxylic ions at 155 m/z.

Please note that a problem has occurred in the determination of benzoic acid. A larger amount of benzoic acid was found in the extraction blank than in the sample. We will determine the source of the benzoic acid artifact before the next acid/phenol sample queue is started.

If you should have any questions, please feel free to contact me.

Sincerely,

Dennis D. Fine

Dennis D. Fine

xc: J.L. Seeley
G.B. Smith
R.L. Cosby

Table I. Quantitative Report and QC Data for Phenols and Aliphatic and Aromatic Acids for Samples from Rickenbacken ANGB (Service Request SF-1-118).

		Extraction Blank	50 ppb Extraction Recovery	MW45
1	PROPANOIC ACID – PFB	22	44	1594
2	2-METHYLPROPANOIC ACID – PFB	5	14	76
3	TRIMETHYLACETIC ACID – PFB	5	52	166
4	BUTYRIC ACID – PFB	11	11	121
5	2-METHYLBUTYRIC ACID – PFB	---	41	187
6	3-METHYLBUTYRIC ACID – PFB	---	38	257
7	3,3-DIMETHYLBUTYRIC ACID – PFB	N.F.	58	144
8	PENTANOIC ACID – PFB	7	41	110
9	2,3-DIMETHYLBUTYRIC ACID – PFB	N.F.	56	668
10	2-ETHYLBUTYRIC ACID – PFB	N.F.	57	20
11	2-METHYLPENTANOIC ACID – PFB	N.F.	59	44
12	3-METHYLPENTANOIC ACID – PFB	N.F.	56	248
13	4-METHYLPENTANOIC ACID – PFB	N.F.	57	70
14	HEXANOIC ACID – PFB	20	61	33
15	2-METHYLHEXANOIC ACID – PFB	N.F.	63	14
16	PHENOL – PFB	---	52	---
17	CYCLOPENTANECARBOXYLIC ACID – PFB	N.F.	45	25
18	5-METHYLHEXANOIC ACID – PFB	N.F.	61	9
19	o-CRESOL – PFB	N.F.	63	N.F.
20	2-ETHYLHEXANOIC ACID – PFB	---	64	1938
21	HEPTANOIC ACID – PFB	8	64	---
22	m-CRESOL – PFB	N.F.	61	N.F.
23	p-CRESOL – PFB	N.F.	60	---
24	1-CYCLOPENTENE-1-CARBOXYLIC ACID – PFB	N.F.	43	N.F.
25	o-ETHYLPHENOL – PFB	N.F.	63	N.F.
26	CYCLOPENTANEACETIC ACID – PFB	N.F.	59	20
27	2,6-DIMETHYLPHENOL – PFB	N.F.	50	N.F.
28	2,5-DIMETHYLPHENOL – PFB	N.F.	56	N.F.
29	CYCLOHEXANECARBOXYLIC ACID – PFB	N.F.	61	14
30	3-CYCLOHEXENE-1-CARBOXYLIC ACID – PFB	---	55	N.F.
31	2,4-DIMETHYLPHENOL – PFB	N.F.	48	N.F.
32	3,5-DIMETHYLPHENOL & M-ETHYLPHENOL – PFB	N.F.	131	N.F.
33	OCTANOIC ACID – PFB	---	54	5
34	2,3-DIMETHYLPHENOL – PFB	N.F.	62	N.F.
35	p-ETHYLPHENOL – PFB	N.F.	67	N.F.
36	BENZOIC ACID – PFB	88	71	19
37	3,4-DIMETHYLPHENOL – PFB	N.F.	63	N.F.
38	m-METHYLBENZOIC ACID – PFB	N.F.	45	---
39	1-CYCLOHEXENE-1-CARBOXYLIC ACID – PFB	N.F.	59	N.F.
40	CYCLOHEXANEACETIC ACID – PFB	N.F.	67	166
41	2-PHENYLPROPANOIC ACID – PFB	N.F.	60	---
42	o-METHYLBENZOIC ACID – PFB	N.F.	59	---
43	PHENYLACETIC ACID – PFB	---	56	5
44	m-TOLYLACETIC ACID – PFB	N.F.	43	6
45	o-TOLYLACETIC ACID – PFB	N.F.	42	---
46	2,6-DIMETHYLBENZOIC ACID – PFB	N.F.	65	---
47	p-TOLYLACETIC ACID – PFB	N.F.	43	---
48	p-METHYLBENZOIC ACID – PFB	N.F.	59	7
49	3-PHENYLPROPANOIC ACID – PFB	N.F.	53	---
50	2,5-DIMETHYLBENZOIC ACID – PFB	N.F.	58	---
51	DECANOIC ACID – PFB	---	62	---
52	2,4-DIMETHYLBENZOIC ACID – PFB	N.F.	62	---
53	3,5-DIMETHYLBENZOIC ACID – PFB	N.F.	49	---
54	2,3-DIMETHYLBENZOIC ACID – PFB	N.F.	61	---
55	4-ETHYLBENZOIC ACID – PFB	N.F.	65	---
56	2,4,6-TRIMETHYLBENZOIC ACID – PFB	N.F.	69	8
57	3,4-DIMETHYLBENZOIC ACID – PFB	N.F.	60	7
58	2,4,5-TRIMETHYLBENZOIC ACID – PFB	N.F.	61	---

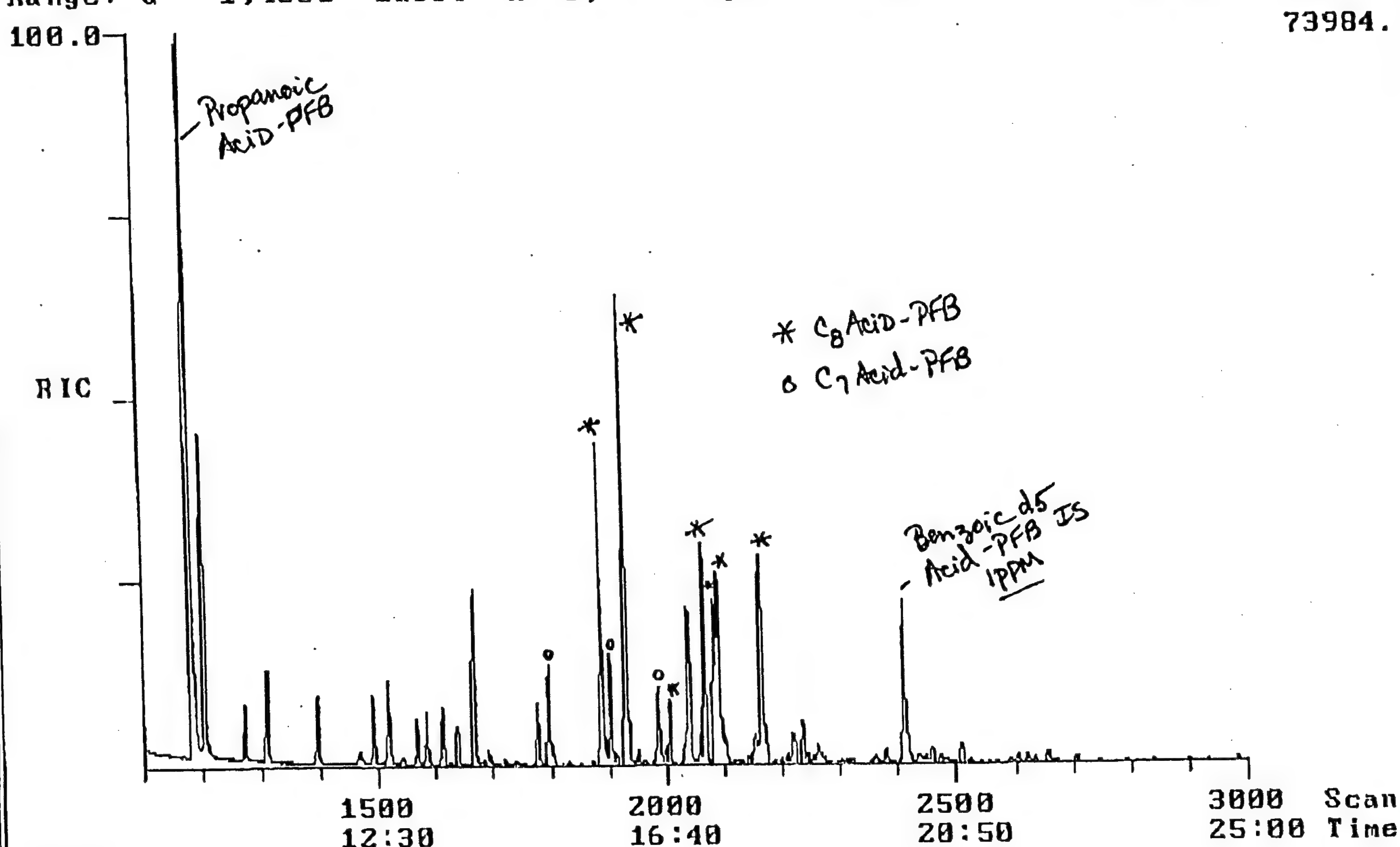
--- indicates concentration of extract was below lowest calibration standard (5 ppb).

N.F. indicates not found.

RIC
04/13/95 17:42:00
Sample: 50ML SAMPLE MW5
Conds.: 50C(1M) TO 100C 30C/M TO 300C 6C/M SPLITLESS 1M DB5MS60.25.25
Range: G 1,4000 Label: N 0, 4.0 Quan: A 0, 1.0 J 0 Base: U 20, 3

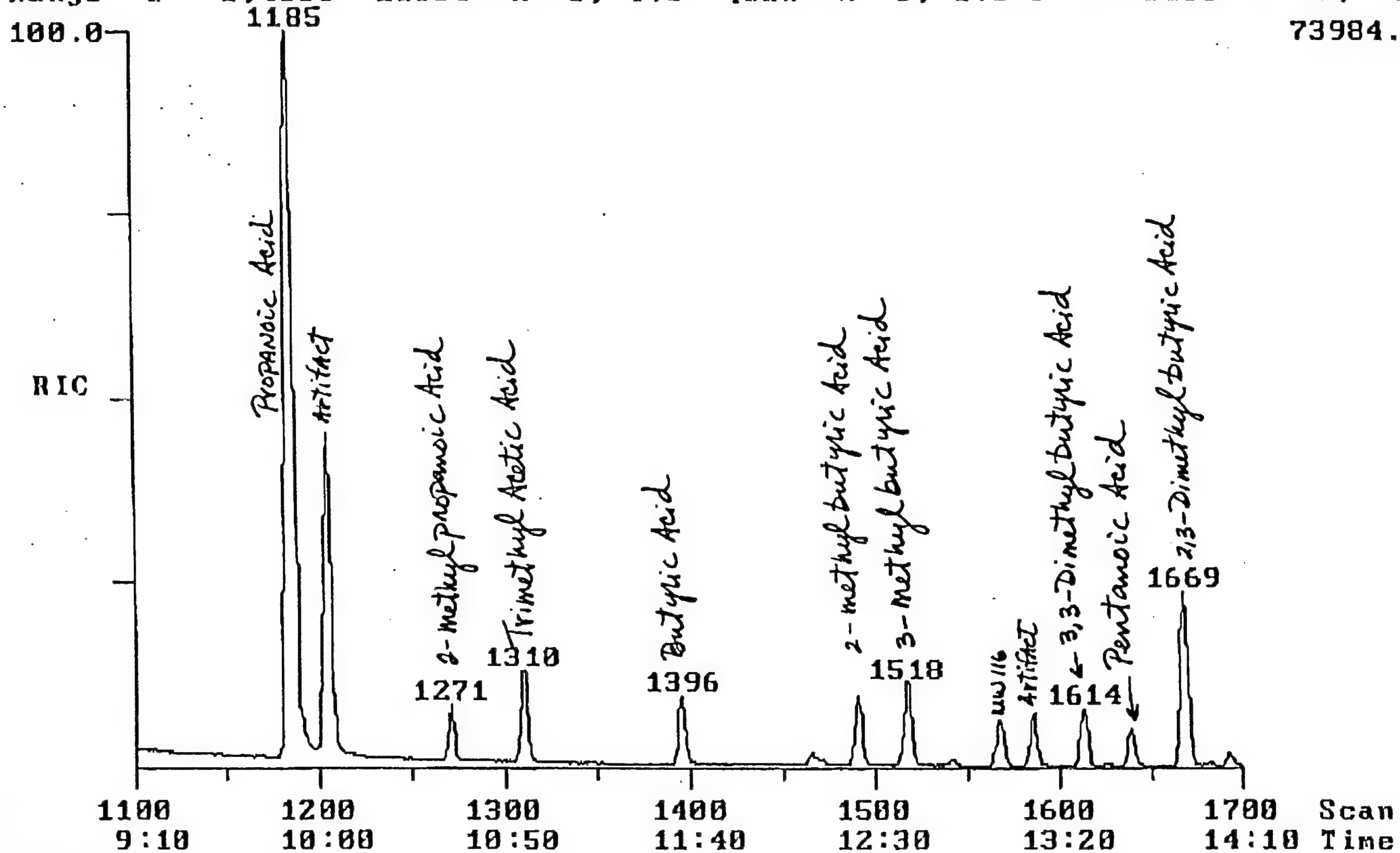
Data: 694MW5 #1
Cali: NICAL412 #3

Scans 1100 to 3000



CHRO:

RIC   Data: 694MW5 #1   Scans 1100 to 1700
04/13/95 17:42:00   Cali: NICAL412 #3
Sample: 50ML SAMPLE MW5
Conds.: 50C(1M) TO 100C 30C/M TO 300C 6C/M SPLITLESS 1M DB5MS60.25.25
Range: G 1,4000 Label: N 0, 4.0 Quan: A 0, 1.0 J 0 Base: U 20, 3

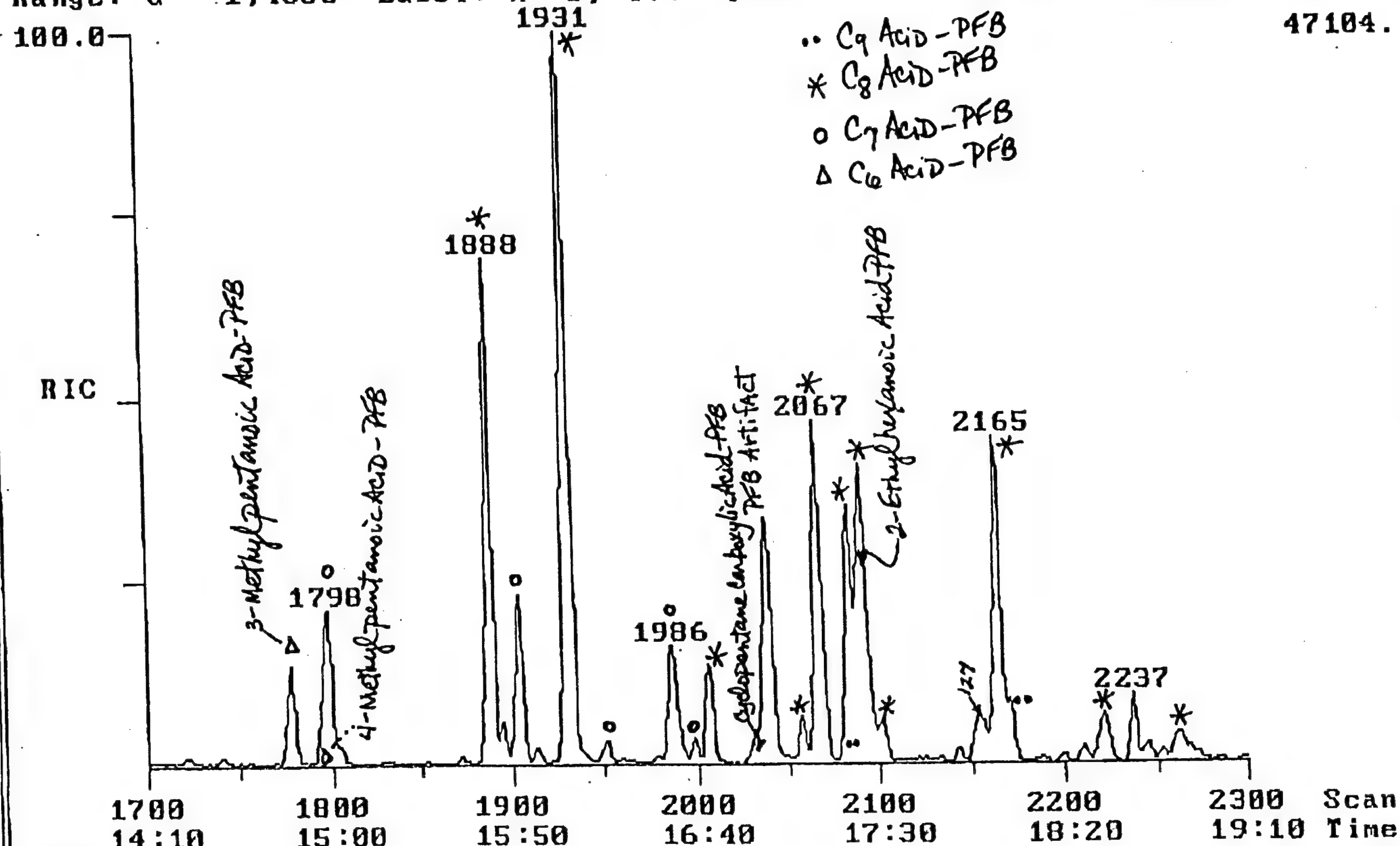


CHRO:

RIC
04/13/95 17:42:00
Sample: 50ML SAMPLE MW5
Conds.: 50C(1M) TO 100C 30C/M TO 300C 6C/M SPLITLESS 1M DB5MS60.25.25
Range: G 1,4000 Label: N 0, 4.0 Quan: A 0, 1.0 J 0 Base: U 20, 3

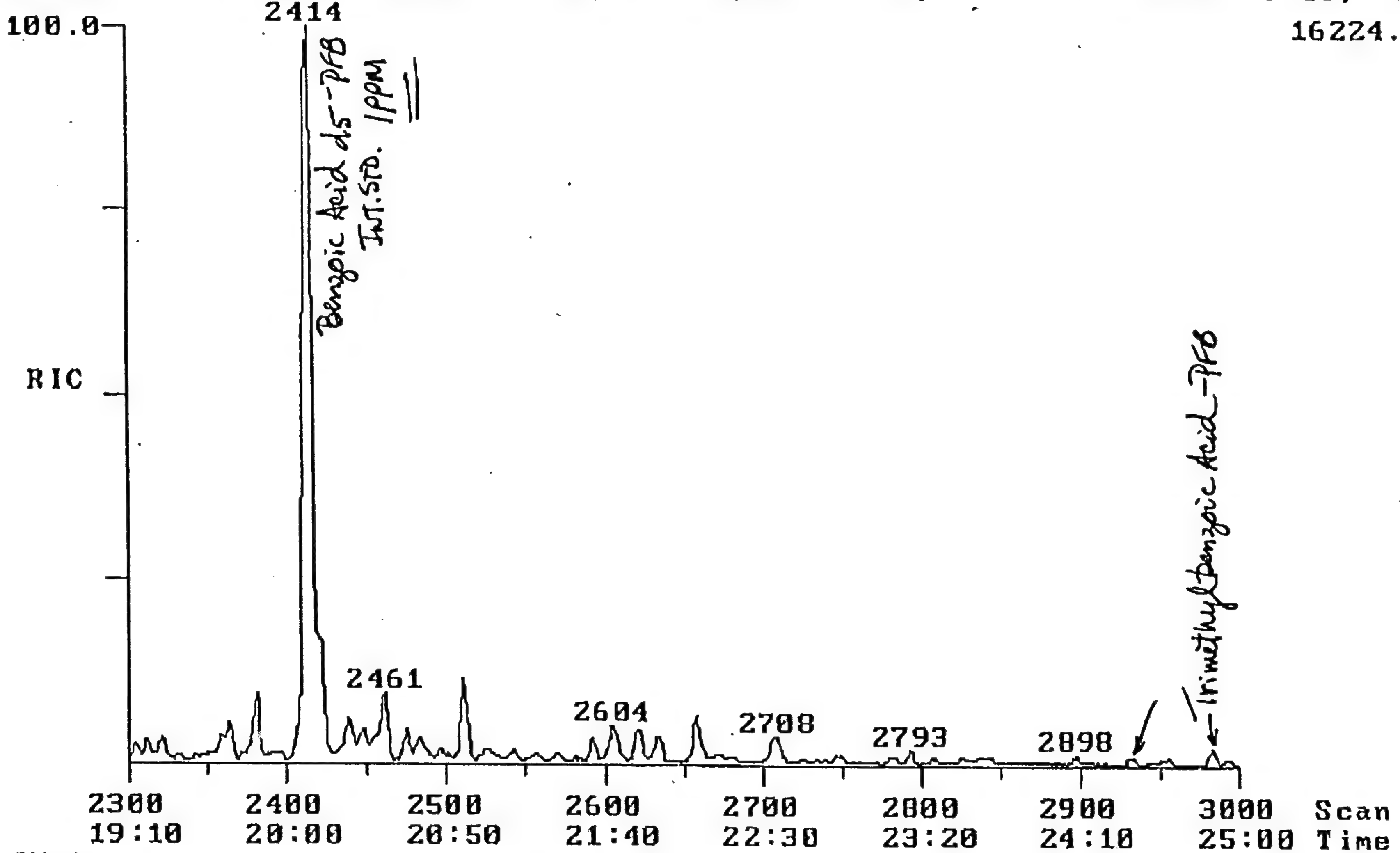
Data: 694MW5 #2039
Cali: NICAL412 #3

Scans 1700 to 2300



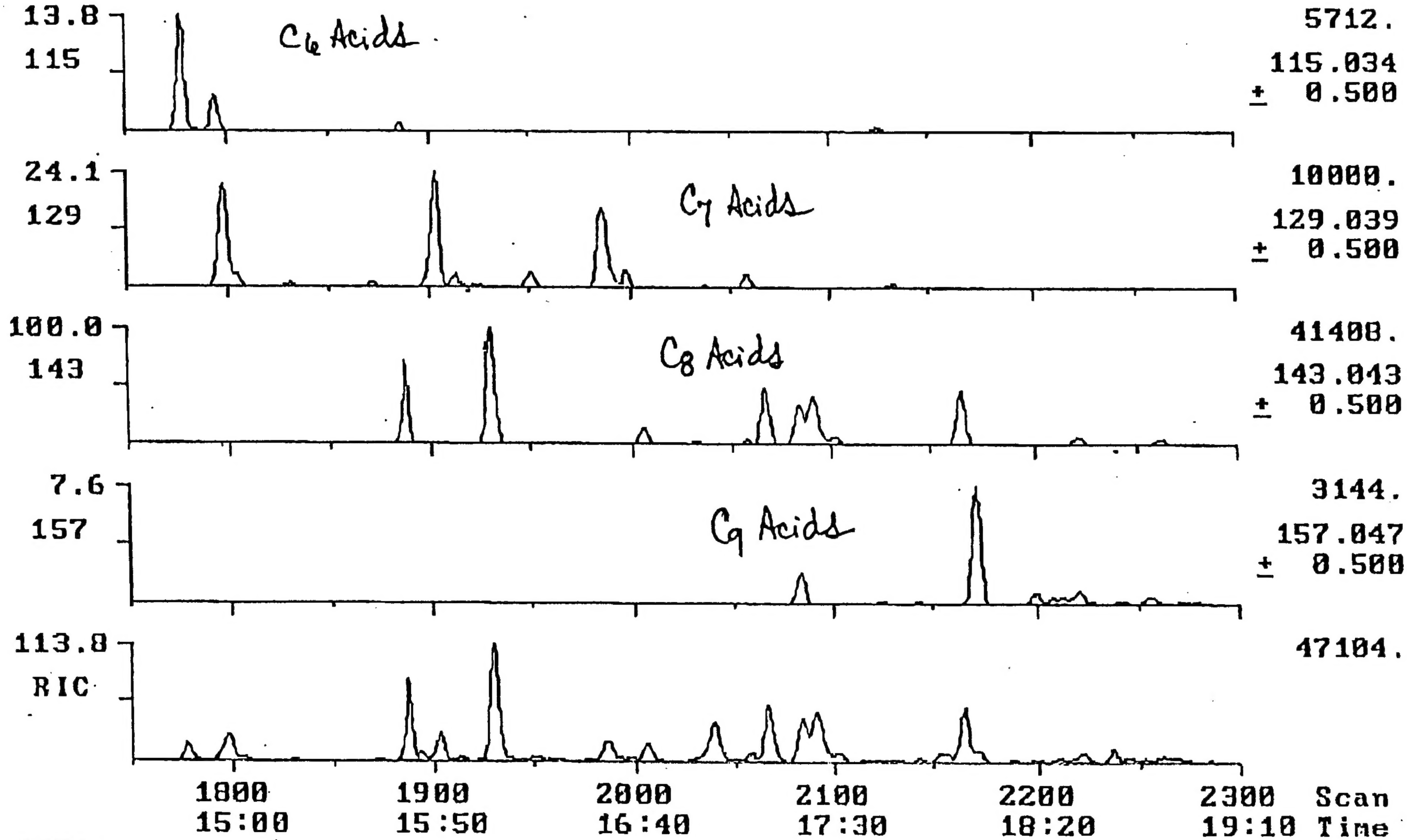
CHRO:

RIC   Data: 694MW5 #1   Scans 2300 to 3000
04/13/95 17:42:00   Cali: NICAL412 #3
Sample: 50ML SAMPLE MW5
Conds.: 50C(1M) TO 100C 30C/M TO 300C 6C/M SPLITLESS 1M DB5MS60.25.25
Range: G 1,4000 Label: N 0, 4.0 Quan: A 0, 1.0 J 0 Base: U 20, 3



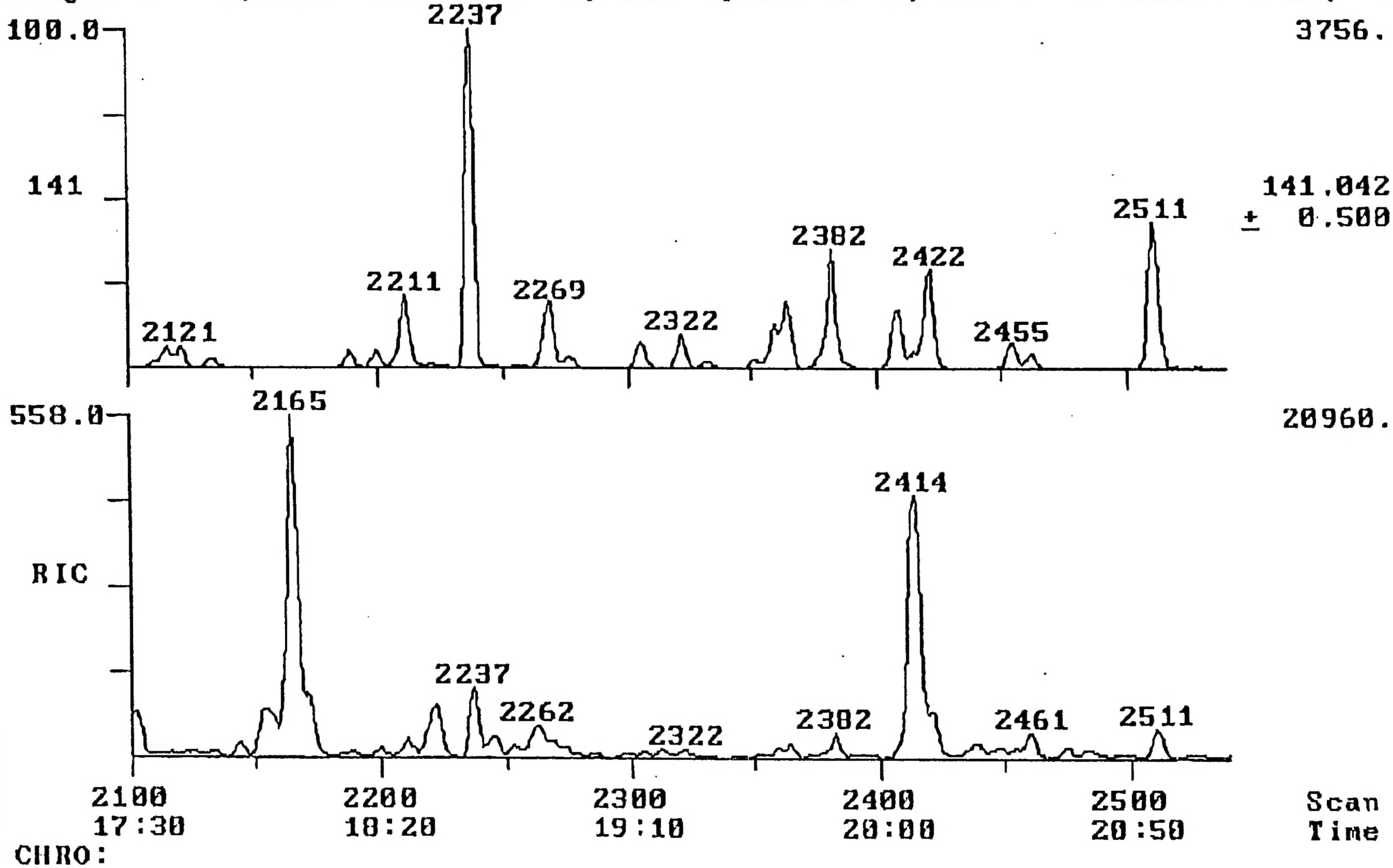
CHRO:

RIC+Mass Chromatograms   Data: 694MW5 #2237   Scans 1750 to 2300
04/13/95 17:42:00   Cali: 694MW5 #3
Sample: 50ML SAMPLE MW5
Conds.: 50C(1M) TO 100C 30C/M TO 300C 6C/M SPLITLESS 1M DB5MS60.25.25
Range: G 1,4000 Label: N 0, 4.0 Quan: A 0, 1.0 J 0 Base: U 20, 3



CHRO:

RIC+Mass Chromatogram Data: 694MW5 #2237 Scans 2100 to 2540
04/13/95 17:42:00 Cali: 694MW5 #3
Sample: 50ML SAMPLE MW5
Conds.: 50C(1M) TO 100C 30C/M TO 300C 6C/M SPLITLESS 1M DB5MS60.25.25
Range: G 1,4000 Label: N 0, 4.0 Quan: A 0, 1.0 J 0 Base: U 20, 3



RIC+Mass Chromatogram Data: 694MW5 #2237 Scans 2170 to 2850
04/13/95 17:42:00 Cali: 694MW5 #3
Sample: 50ML SAMPLE MW5
Conds.: 50C(1M) TO 100C 30C/M TO 300C 6C/M SPLITLESS 1M DB5MS60.25.25
Range: G 1,4000 Label: N 0, 4.0 Quan: A 0, 1.0 J 0 Base: U 20, 3

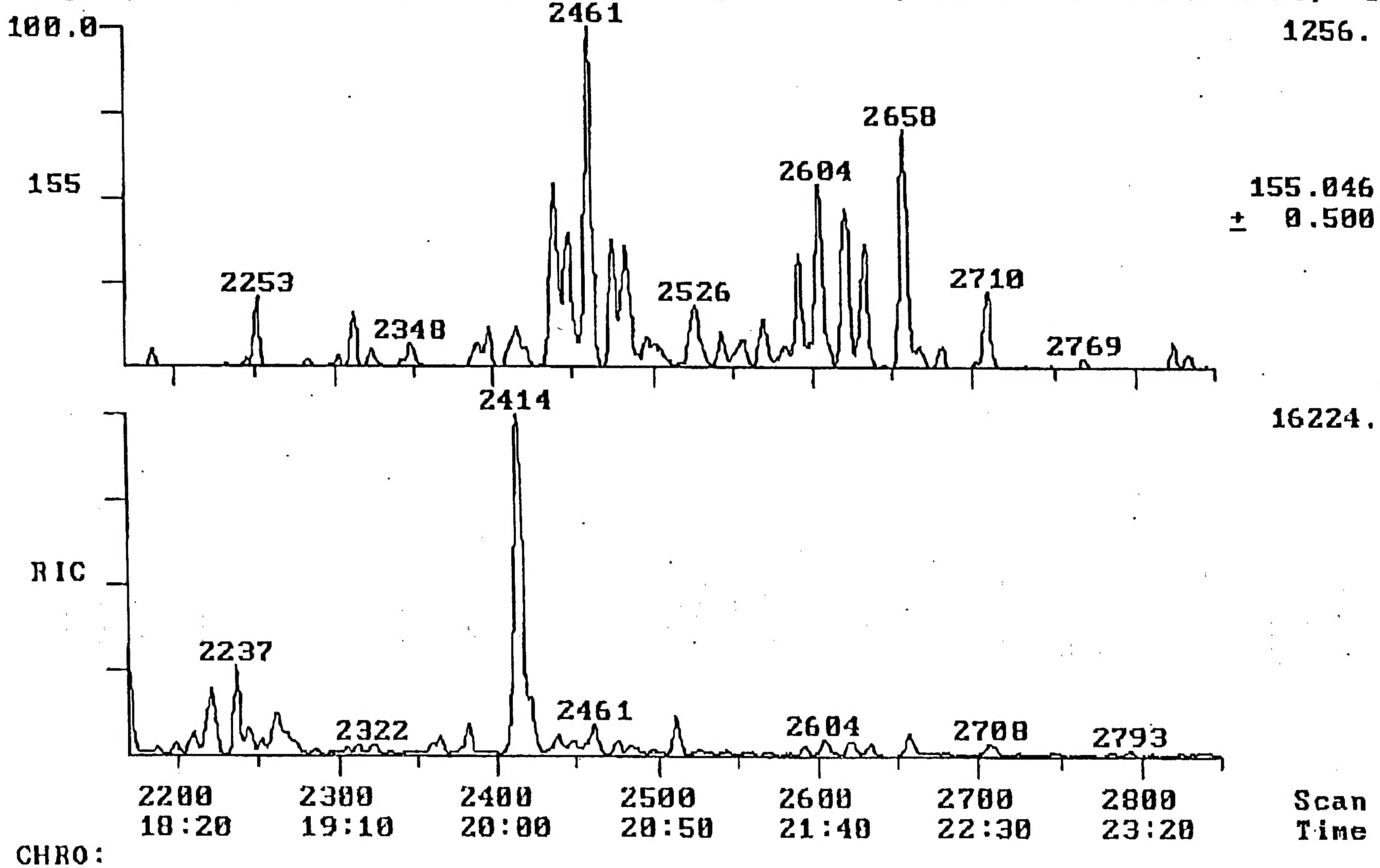


Table I. Quantitative Report and QC Data for Phenols and Aliphatic and Aromatic Acids for Samples from Rickenbacker AFB (Service Request SF-1-118).

Concentration ppb

		ESMP-13S	ESMP-13D	10 ppb Check Standard	100 ppb Check Standard	Standard Derivative Blank	Standard Derivative Blank	Extraction Method Blank	% Extraction Recovery of 50 ppb Spike
1	PROPANOIC ACID – PFB	840	19	17	116	11	16	14	11
2	2-METHYLPROPANOIC ACID – PFB	154	8	14	116	***	6	6	43
3	TRIMETHYLACETIC ACID – PFB	***	12	12	122	***	***	8	113
4	BUTYRIC ACID – PFB	144	7	15	114	8	11	9	33
5	2-METHYLBUTYRIC ACID – PFB	92	***	10	116	***	***	**	91
6	3-METHYLBUTYRIC ACID – PFB	112	***	10	116	***	***	**	86
7	3,3-DIMETHYLBUTYRIC ACID – PFB	***	N.F.	11	118	N.F.	N.F.	N.F	119
8	PENTANOIC ACID – PFB	43	***	13	113	***	***	7	99
9	2,3-DIMETHYLBUTYRIC ACID – PFB	5	N.F.	11	119	N.F.	N.F.	N.F	118
10	2-ETHYLBUTYRIC ACID – PFB	N.F.	N.F.	8	117	N.F.	N.F.	N.F	120
11	2-METHYLPENTANOIC ACID – PFB	9	N.F.	8	115	N.F.	N.F.	N.F	123
12	3-METHYLPENTANOIC ACID – PFB	5	N.F.	8	112	***	N.F.	N.F	120
13	4-METHYLPENTANOIC ACID – PFB	***	N.F.	8	112	N.F.	N.F.	N.F	121
14	HEXANOIC ACID – PFB	29	7	12	115	5	5	**	136
15	2-METHYLHEXANOIC ACID – PFB	***	N.F.	8	113	N.F.	N.F.	N.F	130
16	PHENOL – PFB	***	***	12	99	***	***	**	113
17	CYCLOPENTANECARBOXYLIC ACID – PFB	5	N.F.	7	107	N.F.	N.F.	N.F	106
18	5-METHYLHEXANOIC ACID – PFB	***	***	11	110	***	***	**	144
19	o-CRESOL – PFB	N.F.	N.F.	11	127	N.F.	N.F.	N.F	124
20	2-ETHYLHEXANOIC ACID – PFB	285	***	12	123	***	***	**	126
21	HEPTANOIC ACID – PFB	***	***	10	116	***	***	**	131
22	m-CRESOL – PFB	N.F.	N.F.	11	126	N.F.	N.F.	N.F	123
23	p-CRESOL – PFB	N.F.	N.F.	11	127	N.F.	N.F.	N.F	123
24	1-CYCLOPENTENE-1-CARBOXYLIC ACID – PFB	N.F.	N.F.	11	113	N.F.	N.F.	N.F	96
25	o-ETHYLPHENOL – PFB	N.F.	N.F.	10	126	N.F.	N.F.	N.F	127
26	CYCLOPENTANEACETIC ACID – PFB	N.F.	N.F.	7	113	N.F.	N.F.	N.F	120
27	2,6-DIMETHYLPHENOL – PFB	N.F.	N.F.	9	127	N.F.	N.F.	N.F	118
28	2,5-DIMETHYLPHENOL – PFB	N.F.	N.F.	10	130	N.F.	N.F.	N.F	122
29	CYCLOHEXANECARBOXYLIC ACID – PFB	***	N.F.	7	111	N.F.	N.F.	N.F	120
30	3-CYCLOHEXENE-1-CARBOXYLIC ACID – PFB	N.F.	N.F.	11	120	***	N.F.	**	117
31	2,4-DIMETHYLPHENOL – PFB	N.F.	N.F.	10	139	N.F.	N.F.	N.F	104
32	3,5-DIMETHYLPHENOL & M-ETHYLPHENOL – PFB	N.F.	N.F.	10	132	N.F.	N.F.	N.F	126
33	OCTANOIC ACID – PFB	***	***	14	118	***	***	**	127
34	2,3-DIMETHYLPHENOL – PFB	N.F.	N.F.	10	127	N.F.	N.F.	N.F	122
35	p-ETHYLPHENOL – PFB	N.F.	N.F.	10	130	N.F.	N.F.	N.F	126
36	BENZOIC ACID – PFB	36	33	95	161	***	23	**	159
37	3,4-DIMETHYLPHENOL – PFB	N.F.	N.F.	10	135	N.F.	N.F.	N.F	119
38	m-METHYLBENZOIC ACID – PFB	20	N.F.	11	110	N.F.	N.F.	N.F	105
39	1-CYCLOHEXENE-1-CARBOXYLIC ACID – PFB	N.F.	N.F.	11	109	N.F.	N.F.	N.F	123
40	CYCLOHEXANEACETIC ACID – PFB	N.F.	N.F.	7	111	N.F.	N.F.	N.F	127
41	2-PHENYLPROPANOIC ACID – PFB	N.F.	N.F.	10	113	N.F.	N.F.	N.F	118
42	o-METHYLBENZOIC ACID – PFB	***	N.F.	10	118	N.F.	N.F.	N.F	120
43	PHENYLACETIC ACID – PFB	***	***	10	112	***	***	**	120
44	m-TOLYLACETIC ACID – PFB	N.F.	N.F.	10	100	N.F.	N.F.	N.F	120
45	o-TOLYLACETIC ACID – PFB	N.F.	N.F.	14	92	N.F.	N.F.	N.F	143
46	2,6-DIMETHYLBENZOIC ACID – PFB	N.F.	N.F.	12	120	N.F.	N.F.	N.F	136
47	p-TOLYLACETIC ACID – PFB	N.F.	N.F.	9	104	N.F.	N.F.	N.F	155
48	p-METHYLBENZOIC ACID – PFB	***	N.F.	10	111	N.F.	N.F.	N.F	125
49	3-PHENYLPROPANOIC ACID – PFB	***	N.F.	11	106	N.F.	N.F.	N.F	127
50	2,5-DIMETHYLBENZOIC ACID – PFB	N.F.	N.F.	11	111	N.F.	N.F.	N.F	120
51	DECANOIC ACID – PFB	***	***	12	112	***	***	**	125
52	2,4-DIMETHYLBENZOIC ACID – PFB	***	N.F.	10	116	N.F.	N.F.	N.F	119
53	3,5-DIMETHYLBENZOIC ACID – PFB	***	N.F.	9	107	N.F.	N.F.	N.F	124
54	2,3-DIMETHYLBENZOIC ACID – PFB	N.F.	N.F.	10	114	N.F.	N.F.	N.F	121
55	4-ETHYLBENZOIC ACID – PFB	N.F.	N.F.	10	113	N.F.	N.F.	N.F	116
56	2,4,6-TRIMETHYLBENZOIC ACID – PFB	***	N.F.	10	121	N.F.	N.F.	N.F	120
57	3,4-DIMETHYLBENZOIC ACID – PFB	***	N.F.	10	105	N.F.	N.F.	N.F	117
58	2,4,5-TRIMETHYLBENZOIC ACID – PFB	N.F.	N.F.	9	115	N.F.	N.F.	N.F	131

*** Indicates concentration of extract was below lowest calibration standard (5 ppb).

N.F. Indicates not found.